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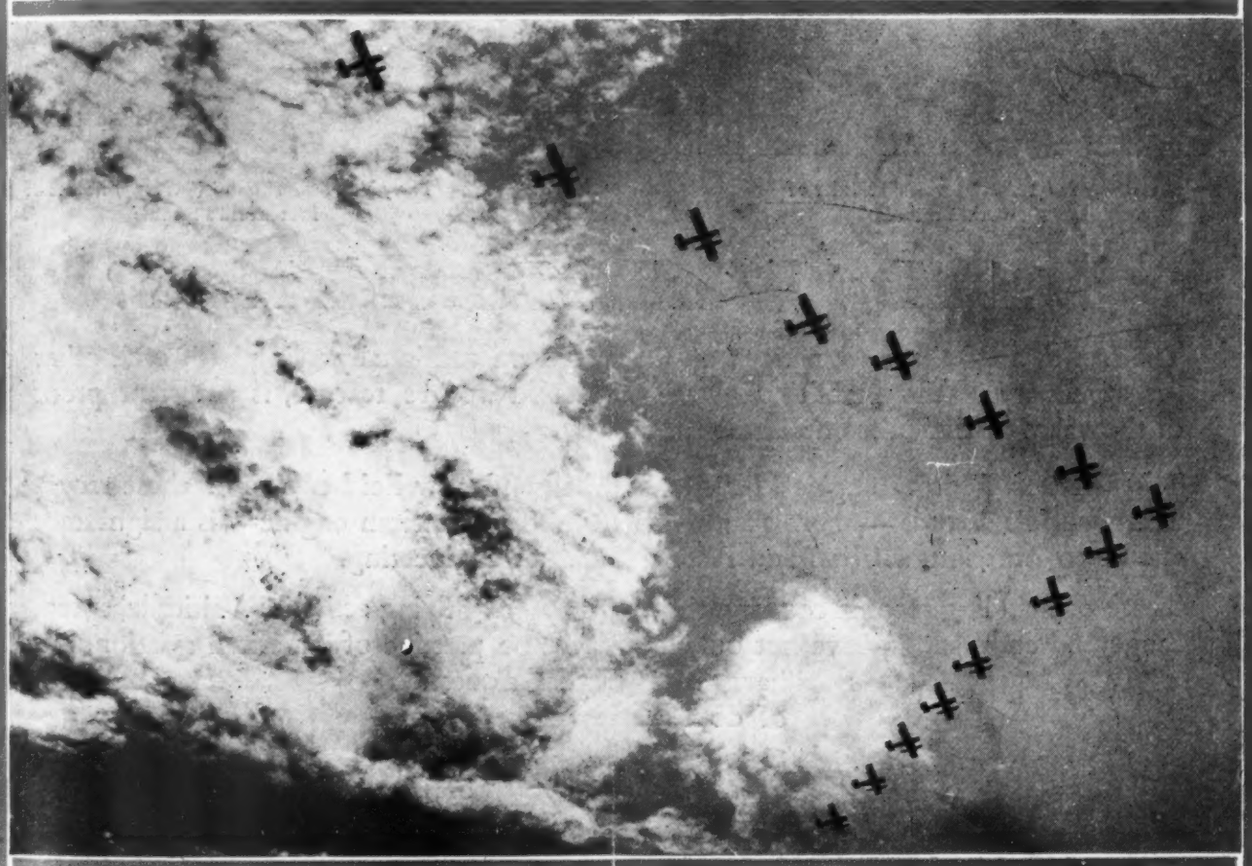
AVIATION

The Oldest American Aeronautical Magazine

OCTOBER 27, 1928 Issued Weekly PRICE 20 CENTS



Fifteen Navy seaplanes in "V" formation flying over Narragansett Bay.

VOLUME XXV

NUMBER 18

Special Features

True Altitude Meters

The Cierva Autogiro

Regarding Engine Oil Temperatures

AVIATION PUBLISHING CORPORATION
250 WEST 57TH STREET, NEW YORK

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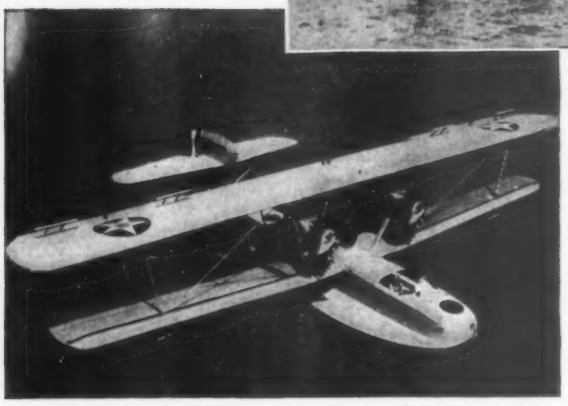
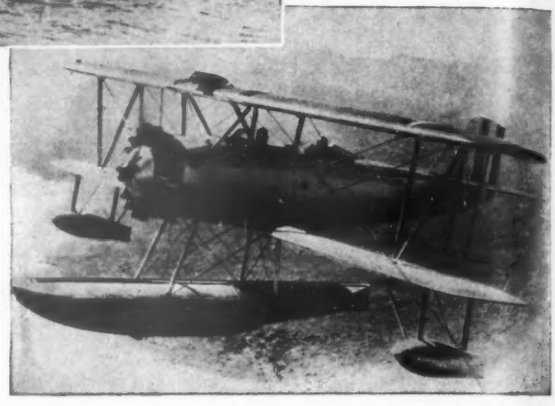


Navy "Apache" ("Wasp") holder of World's Altitude Records for land and sea planes



Navy PN-12 (2 "Hornets") holder of six world's records

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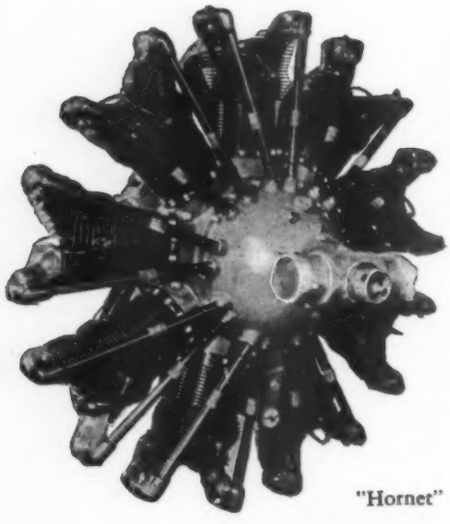

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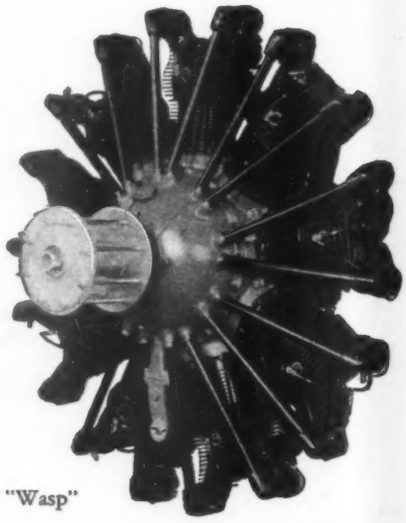

"Wasp"

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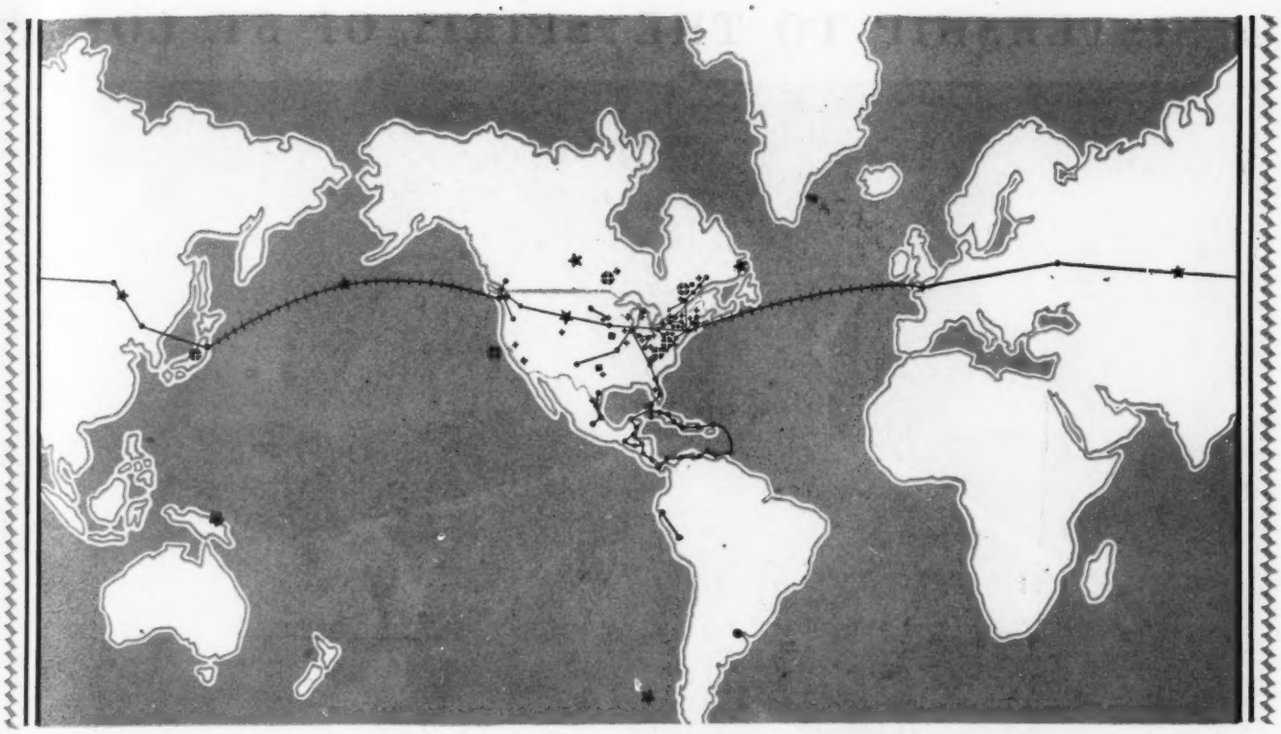

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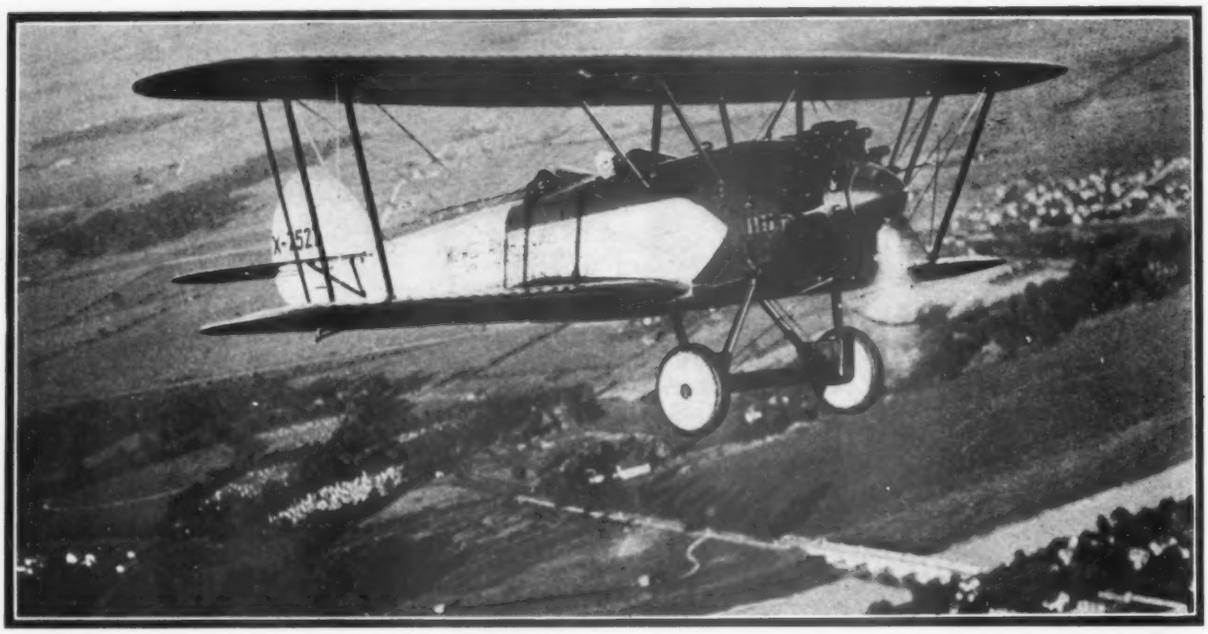

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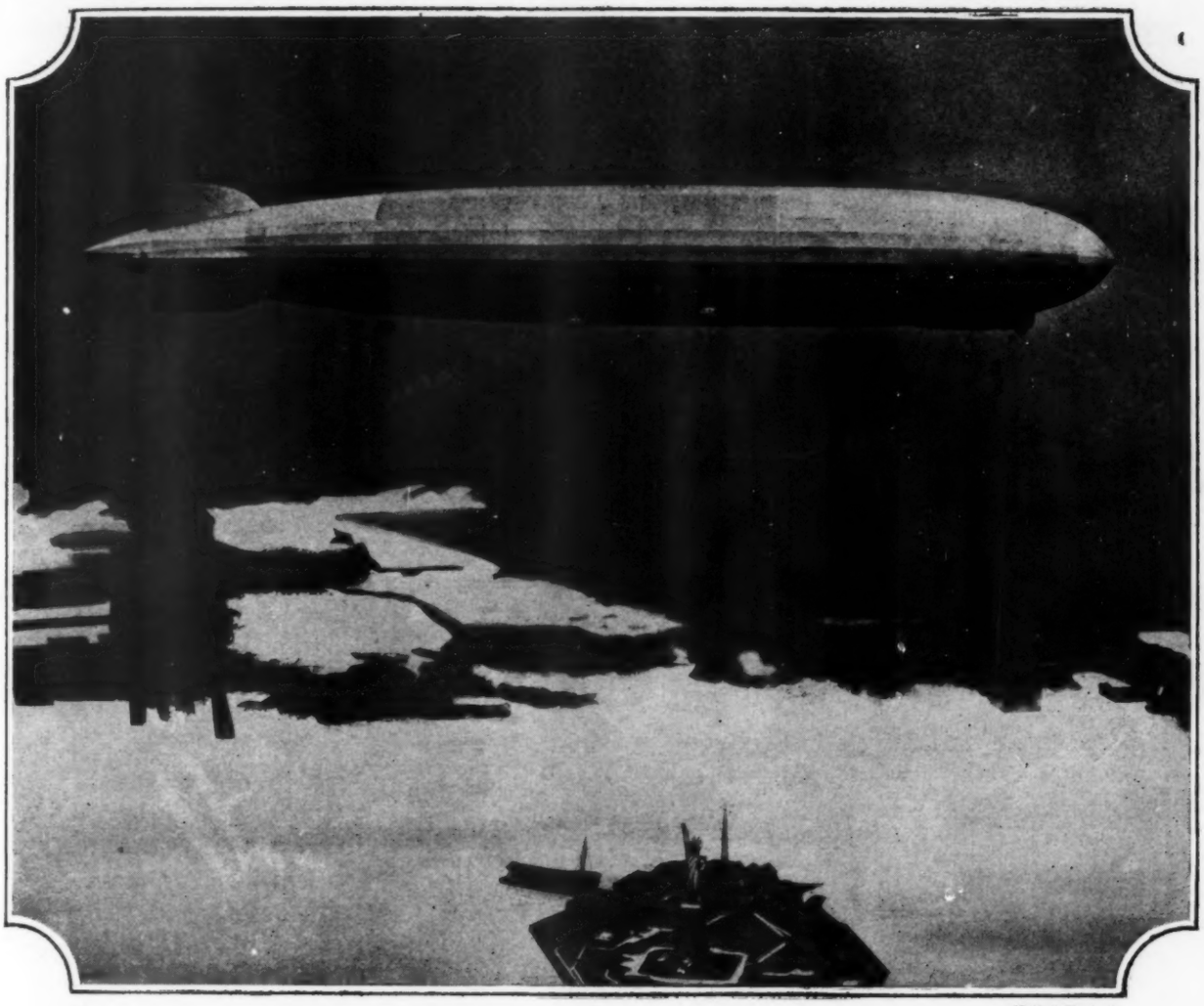

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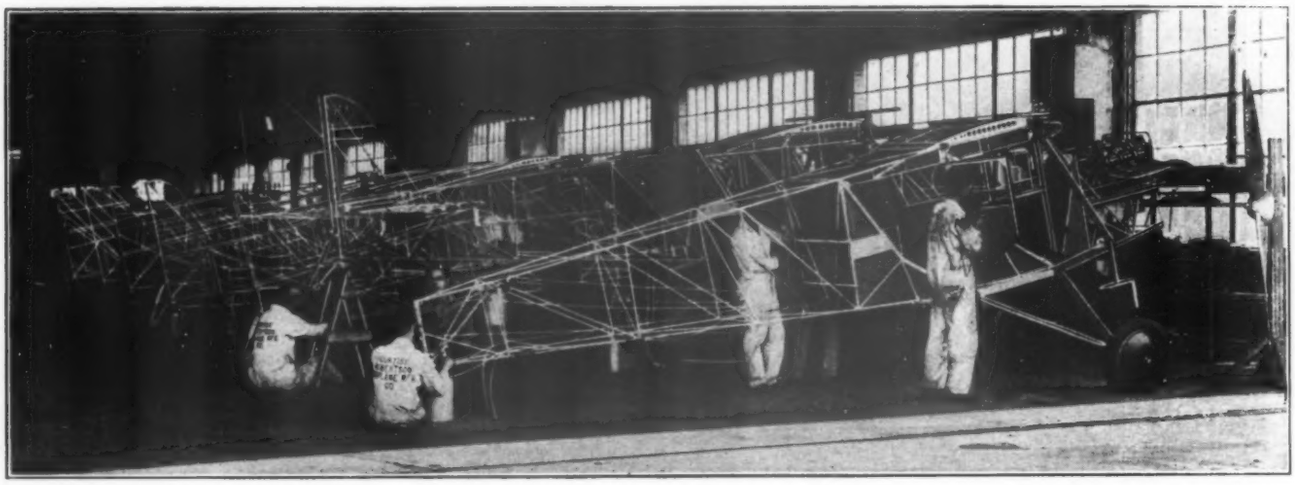

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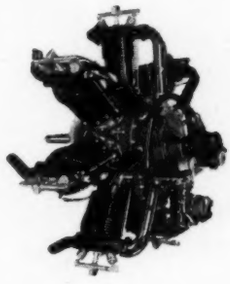

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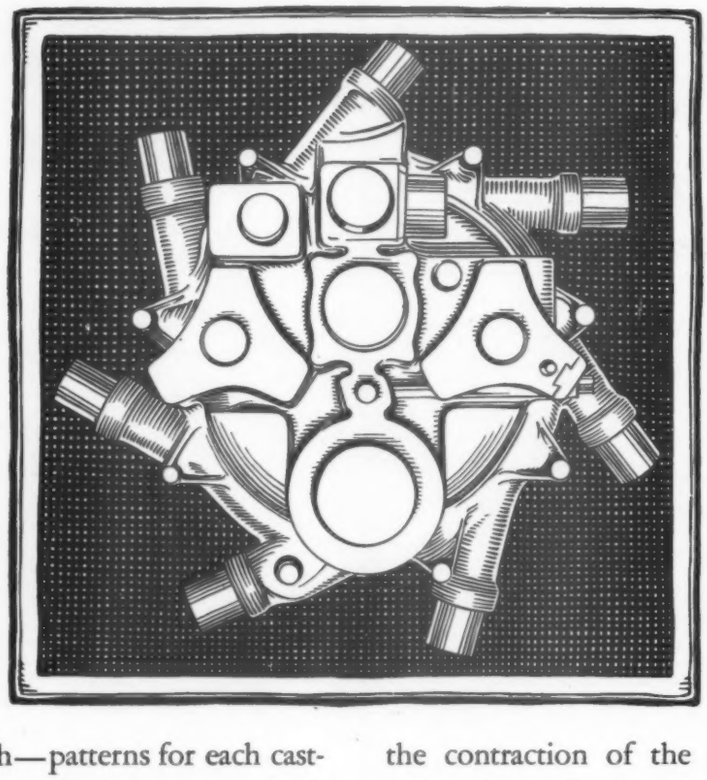

BEFORE engineering ideas represented by a blueprint can be reduced to tangible form—before the metals can be poured which give the engine its light weight and enduring strength—patterns for each casting must be carefully made. Patterns on which will depend the form of the casting—the accuracy of its weight and dimensions—the very success of the engine itself!

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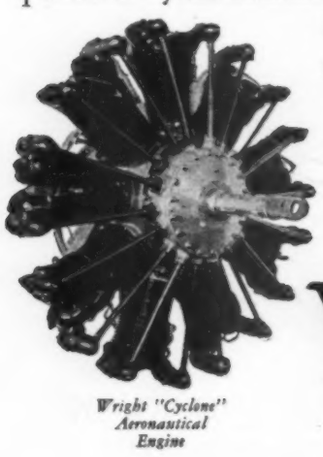

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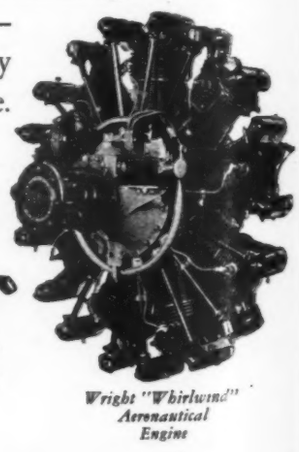

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The Oldest American Aeronautical Magazine

Vol. XXV OCTOBER 27, 1928 No. 18

National Adoption

ACCORDING to reports the airway meteorological experiments now being conducted in California by the Guggenheim Foundation for the Promotion of Aeronautics are proving highly successful as regards the development of a weather reporting system which is accurate, dependable and worthy of national adoption. This work, however, is just what it was originally intended to be . . . a series of experiments to ascertain the most effective way to report weather conditions existing along an airway, and naturally the experiments will not be conducted indefinitely.

Therefore, unless something is done to induce the Government to bring about a national adoption of the system perfected by the Guggenheim Foundation, airline operators will be forced to continue with the present system of weather reporting which is totally incomplete and inadequate for the purpose it should serve. The only other alternative for the progressive airline operator to follow, at the termination of the Guggenheim experiments, would be the individual adoption of the system on his own particular line. Such procedure would not only be costly but wasteful due to the possibility of duplication and overlapping with another line. In addition, there might arise the element of competition in the matter of obtaining weather reports, and that is something which should be absolutely avoided. Adequate weather reporting is but a safety precaution in the operation of an airline, and every airline, regardless of size or financial standing, should have access to the best weather reports obtainable, just as every single ship on the high seas has access to all marine weather reports.

The manner in which government adoption of the Guggenheim weather reporting system should be solicited is something to be decided in the near future. A combine appeal of all airline operators might prove fruitful, or perhaps a combined appeal of the entire industry would bring forth the desired results. For the Government to nationally adopt the Guggenheim system would not be subsidizing American aeronautics any more than the maintenance of a marine weather reporting system is subsidizing American shipping. And for that matter, there is no necessity of the Government standing the entire expense. Some arrangement could be made whereby each airline operator could pay a proportionate share of the cost of the installation and maintenance of the system over his particular line.

However, such details can be worked out easily enough. The fact remains that the Guggenheim Foundation for the Promotion of Aeronautics has, of its own volition, conducted a series of weather reporting experiments, the results of which are worthy of national adoption. To let this contribution go by the board would be a most pronounced setback for American aeronautics in the struggle against its greatest enemy . . . the elements.

Taxi Business

DURING the Summer and Fall of 1927 aerial taxi companies all over the country reaped a golden harvest in "joy hopping" the public at so much per head. It was a common sight on Sundays and holidays to see hundreds of men, women and children flocking about the planes on an airport or flying field, each anxious to experience the thrill of a five minute hop about the field. To take care of the then seemingly increasing amount of business many of the aerial taxi operators bought additional planes. The business did increase and the amount of profit made on some days was almost unbelievable.

However, all good things eventually come to an end, and although the golden harvest continued for awhile at the beginning of this year, with the coming of Summer the joy hopping business took a most decided slump. To encourage a revival, prices were gradually reduced to a point where hops were made almost at a loss. The result is, that many taxi companies have more planes than they need for the joy hopping business that exists.

At first glance this might be considered an alarming condition, but, according to operators who reaped the golden harvest and are still in business, while there is a decrease in short hops for pleasure there is an increase in long flights for business reasons. In short, the public is beginning to patronize the most modern means of transportation because it is an asset in every day life.

Long flights would seem to be the best kind of business for aerial taxi companies to solicit, for while joy hops may bring abundant profits temporarily, long flights go toward building up a clientele that will produce repeat business, which, after all, is the best kind of business. For the present, however, it might be advisable for the taxi operators to concentrate on organizations rather than individuals. The cost of a long flight is not within reach of the man of average means, and will continue to remain so until the well known element of production brings it down to fit his pocketbook. On the other hand, it is well worth the cost to an organization if its officials and executives can be transported from one spot to another at short notice and in the least possible amount of time.

To obtain that type of business, calls for the inauguration of educational advertising campaigns, direct or otherwise. Convincing presentations of the advantages of using the facilities of aerial taxi companies when an established airline cannot be used have converted many business and fraternal organizations in the past, and there is no reason to believe why a concentration on the thousands yet to be converted would not produce most satisfying results. For those aerial taxi operators who lack the knowledge of how to go after such business there are many individuals and advertising agencies who have studied the aeronautical industry, and the best methods of soliciting the patronage of other industries.

The Cierva Autogiro

Some Interesting Information Regarding the Aerodynamic Principles Involved in the Design and Operation of This New Craft

By W. H. Sayers
Technical Editor of "THE AEROPLANE"

THE Cierva Autogiro, which has attracted a great deal of interest in Europe during the past few years and will probably attract much attention in America when it appears among the competitors in the Guggenheim Safety Competitions, is an aircraft which stands in a class by itself.

It is not an airplane for it has a rotating system of supporting surfaces in the place of wings. It is not a helicopter for this rotating system is not driven by the machine's power plant but is merely carried on free bearings and kept rotating by air forces alone.

Apart from the "rotating wing" system the Autogiro resembles the normal tractor airplane in practically every respect. It is fitted with a normal type of engine driving an ordinary propeller. All the Autogiros as yet built have a standard airplane fuselage, landing gear and tail unit. The controls used are similar to those of the airplane except that ailerons, which cannot be carried on the rotating wing, are separate organs carried on each side of the fuselage by a structure specially provided for this purpose.

The Result of Long Development

This type of machine is the result of a long process of development by Señor Juan de la Cierva, Spanish engineer, whose experiments with gliders and power driven aircraft between 1911 and 1918 had convinced him of the importance of discovering some method for supporting heavier-than-air flying machines which did not make necessary the maintenance of a high forward speed, and which was not subject to the danger of stalling.

The possibility of using rotating vanes for this purpose was early recognized, and the first Autogiro, built some time about 1920, was provided with two sets of rotating vanes, one above the other, which were to be kept in rotation in opposite senses by air forces alone. Unfortunately, owing to interference between the two vanes, the lower vane refused to turn at more than two-thirds the speed of the upper.

When a machine with such rotating wings is in horizontal movement, the blades at one side have a total air speed which is the sum of the rotational speed of the vane, and of the horizontal speed of the machine. On the other side the blades have a total air speed which is the difference of these two speeds. Hence the air forces on the two sides are not in general in balance. The use of twin rotating systems was intended to overcome this lack of balance, and the failure of the vanes to rotate at equal speeds defeated this object.

The next Autogiro had but one rotating wing system and was fitted with a control whereby the pilot was able to vary the relative angle of incidence of the blades during their rotation so that each blade could be given increased incidence where its air speed was low and vice versa, thus securing the required balance of lift. This arrangement proved inadequate to its intended purpose.

A number of other attempts to produce mechanical control systems failed because the out-of-balance forces proved to be unexpectedly large, and because of the enormous inertia of the rotating vane system.

Finally, Señor de la Cierva arrived at the simple and entirely satisfactory method of overcoming this inherent lack of balance which is the distinctive feature of the

Showing the mounting of the rotary wing system of the Cierva Autogiro. Señor de la Cierva, the inventor, is in the front cockpit. Picture was taken just before the recent London to Paris flight. (London News Photo).

Autogiro of today. Each blade was hinged freely to the bearing about which the whole system rotated in such a manner that it was free to fold upwards or droop downwards within wide limits.

When the system is rotating, centrifugal force tends to keep the blades horizontal. Any lift forces on the blades will deflect them upwards from the horizontal and they will lie at an angle, which depends on the relative magnitude of the lift and the centrifugal forces, such as to produce equilibrium.

If centrifugal forces are large in comparison with the lift forces, as they are in fact, this position of equilibrium will not be far removed from the horizontal. Now because the blade is freely hinged at the root, no moment caused by the lift forces will be transmitted through the hinge, which can transmit to the main frame of the machine only the vertical and horizontal components (lift and drag) of the total forces acting on the blade.

Thus even if the lift on a blade at one side of the machine were very much greater than that on the oppo-

site blade, the moment tending to cause the machine to roll over is only the product of the difference between the lift on the two sides multiplied by the radius of the hinge centres from the centre line of the machine. This radius can be kept very small, therefore the moment itself cannot be large.

But there is another result of this hinged blade system. Consider a single blade momentarily lying parallel to the direction of flight of the machine, and with its tip projecting backwards. There is no component of horizontal air speed along the chord of this blade, caused by movement of the machine, and its lift therefore depends on the air speed caused by rotation alone and on its angle of incidence. But as it rotates this state of affairs changes and a steadily increasing component of the forward air speed of the machine is added to the air speed of rotation. The centrifugal force on the blade is caused by the rotation alone and does not change in magnitude. Therefore while the lift is thus increasing, the angle of equilibrium between lift and centrifugal force changes, and the blade is forced upwards. But any such upward movement of the blade means that its angle of incidence to the air is decreased thereby.

Conversely, when the blade passes a position at right angles to the line of flight, the added component of air speed over the blade caused by the forward speed of the machine decreases. The lift also decreases, the blade tends to drop and thereby increases its angle of incidence.

The total result is that the blades in addition to rotating also move up and down, or flap, and by so doing change their incidence in a way which tends to keep the lift on each blade constant.

The rotating vane system used on the Autogiro consists of a number, usually four, of blades each built on a single steel tube spar. These blades are of a normal airfoil section, either of the symmetrical type or with a reflexed camber giving a stationary centre of pressure, so that the main spar is not subject to serious torsional loads. Each spar root is connected through a horizontal hinge to a central block which runs on ball-bearings on a mast projecting above the fuselage of the complete machine. The attachment of the blades is such that each is given a small positive angle of pitch as measured from the axis of the mast.

Cables, in which shock absorbers are incorporated, are attached to the blade spars and to a collar at the top of the mast which is free to rotate with the blades. These cables serve only to prevent the blades from folding right down when the machine is stationary. In practice it is desirable to allow a certain degree of free movement of the blade in the plane of rotation in order to relieve the structure of the fluctuating loads imposed on individual blades. This is achieved by using a secondary hinge and a system of cables between blades which will be described later.

A view showing the method of "winding up" the blades on an early model of the Cierva Autgiro.

Thus apart from the hinges at the blade roots the rotating wing system is merely a large diameter multi-bladed propeller of fine pitch.

The axis of the mast about which the whole rotating system revolves is inclined backwards a few degrees to the normal line of flight of the machine.

When therefore the machine as a whole is moving forward the horizontal air flow may be considered in relation to the rotating vanes as compounded of a large component in the plane of the blades and a small component up through the blades. It is this component of the airflow up through the blades that keeps the whole system rotating.

At first sight it would seem that such an upward component of flow in conjunction with the positive setting

(*Continued on page* 1340)

The Cierva Autogiro, Type C.8.MK.II in the air near Newcastle, England, during the 1928 *race for the King's cup.*

True Altitude Meters

A Resumê of the Experiments Conducted and the Results Obtained in the Development of an Accurate Altimeter

By Lawrence A. Hyland
Radio Engineer

THE outstanding problem of both the military and commercial air services is—The development of means and mechanisms which will permit safe flight in fog or adverse weather and which will enable a landing to be made under such conditions at the conclusion of the flight.

The problem may be divided into three general parts: First, direction finding and field localization; second, stability indication; third, altitude indication.

Recent years have seen much progress in both direction finders and stability indicators. The radio compass, radio beacon and inductor compass have been developed to the point of immediate and reliable application. Improvements in turn, bank and climb indicators have made instrument flying practicable and safe after suitable preliminary flight instruction for the pilot.

Altitude indicators, however, have had no major improvements incorporated in their design for many years. All standard types rely on the barometric principle and are subject to the inaccuracies and serious limitations inherent in atmospheric pressure guages.

While few public announcements have been made, there have been, nevertheless, many laboratories and investigators engaged in research looking to the development of a true altimeter; i. e., one which would indicate the heighth of the aircraft over the ground immediately below. The lines of attack have been as varied as the number of research workers and widely differing reports have been made as to the success of the several experimental models. This article will review briefly the various methods and the results obtained with each to date.

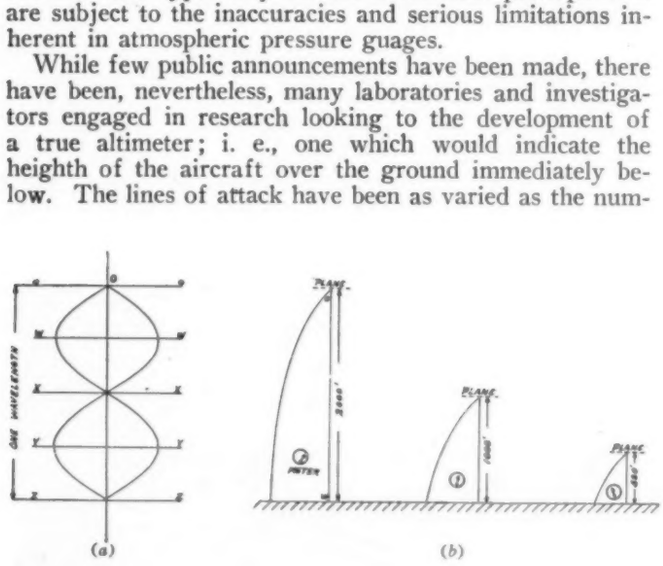
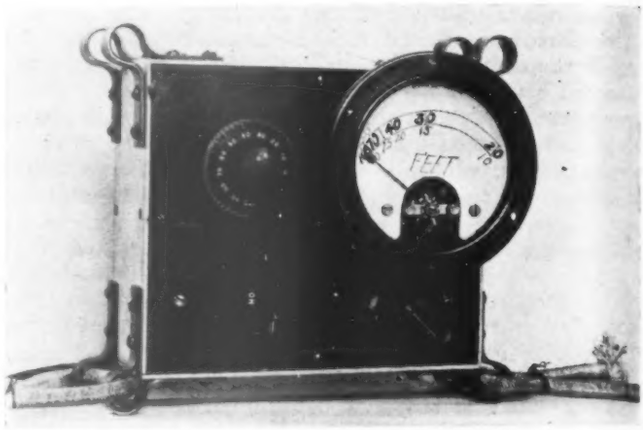


Fig. 1. (a) *A graphical representation of one wavelength of a radio wave.* (*b*) *A diagram showing how the* 8,000 *ft. wavelength was to have been used. At the left, the aircraft is flying at* 2,000 *ft., or a quarter of the wavelength above the earth, and the meter reads maximum. The other drawings show the aircraft at lower altitudes and the reduced meter readings.*

The pursuit of a true altimeter has led to the investigation of mechanical, electrical and acoustic systems. Under artificial conditions a fair determination of true altitude can be obtained by mechanical means. In general the procedure is to time the fall of an object from the aircraft to the ground. Smoke pots or torpedoes are the missiles employed and a stop watch or similar device does the timing. With smoke pots it is necessary to see the ground in order that the burst may be observed while the torpedoes require that the aircraft be in a glide with the engines idling in order that the sound of the explosion reach the ears of the aerial observer. Obviously the scheme has only a limited application, is of no worth when landing and appears to have no possibilities worthy of development.



A photograph of the control box and indicator of the Gunn landing altimeter.

The measuring of altitude on aircraft by means of acoustic instruments has received considerable attention from scientists throughout the world. The most intensive development of this type altimeter has taken place in Germany under the leadership of Dr. Behm, who has adapted his marine sonic depth finder to the special needs of aircraft. The Behm altimeters are of two kinds but have the same general principle and are typical of acoustic altitude measuring apparatus.

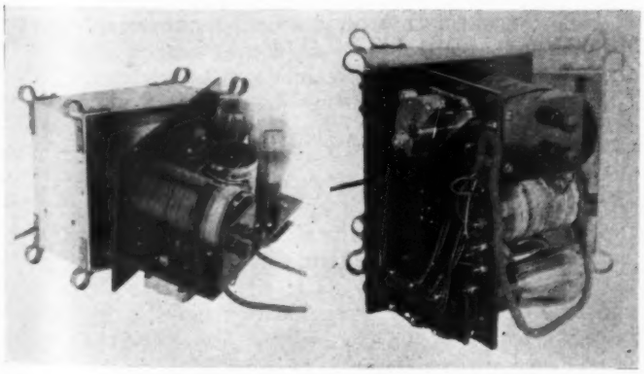
The more precise of the two instruments makes use of a source of sound such as a pistol shot or a short sharply defined pure tone directed, insofar as possible, toward the earth. The sound is reflected from the earth and the reflection or "echo" is picked up by the receiving apparatus aboard the aircraft and supplies the energy to deflect a beam of light. Ordinarily the light beam rests on the zero portion of a scale. At the instant of the pistol shot, however, a timing wheel is automatically released and slowly revolves, causing the beam of light to advance along the scale. When the deflection of the beam occurs the altitude is read directly off the scale at the point of deflection. Tests made with the instrument under labo-

ratory conditions have indicated an accuracy to within a few inches. Successful service tests were made on the dirigible ZR3 (now the U.S.S. "Los Angeles" during the ship's trials in Germany. This type of altimeter was also installed on a Lufthansa passenger plane and extensive tests were made to determine the practicability of the apparatus for airplanes. It was found that with partially muffled engines, "soundings" of fair accuracy could be made up to 150 ft. while much greater altitudes were possible with the engines idling and the plane in a glide.

An interesting feature of the Behm instrument is found in an intensity scale located next to the altitude scale. By noting the intensity of the echo the inventor claims that conclusions may be drawn as to the character of the terrain below.

The second form of the Behm acoustic altimeter utilizes a manually operated timing device and reception by ear. While much less accurate than the automatic instrument, it has the advantage of less complication, lighter weight and (theoretically) offers a better chance to determine the character of the ground underneath by observing the peculiarities of the echo by ear. It would appear that this last feature of the Behm altimeter has been greatly overrated, for the differentiation of the qualities of an echo, to the end that a reasonable guess may be made as to the composition of the reflecting surface, requires long experience, concentration and quiet surroundings, conditions not normal to heavier-than-air craft. Actually this second model of the Behm altimeter differs from the mechanical systems described briefly above only in that the sound making explosion takes place aboard the aircraft. Hence more noise is required for the same altitude.

The primary defect of these altimeters is, of course, the lack of continuous height indication. While Dr. Behm claims that his apparatus will take soundings every second or half second, the fact remains that for landing purposes or in mountain flying the instrument should give the instantaneous value of the altitude. The approximation of this condition would demand cartridge explosions with almost machine gun rapidity over considerable lengths of time prior to a landing. For mountain flying the acoustic system seems to have no value. Altitudes change rapidly and the airplane may be in real danger from a mountain ahead, while the last sounding echo taken as rapidly as possible, but nevertheless delayed by the required time for echo travel, may indicate that the plane has several hundreds or thousands of feet altitude above the terrain below. Time is of the essence. If shots and readings are taken at too slow a rate the altitude above the earth may change between times, but if the shots are made too rapidly there is the likelihood of overlapping echoes and consequent erroneous altitude indications. Further the operation of the acoustic altimeter would demand virtually the whole attention of the pilot if the apparatus were to be of value at all. Yet at the very time when such attention is required the pilot is in a situation demanding all of his faculties and can spare none but the most fleeting glances at the altimeter.



The internal mechanism of the oscillator and control units of the Gunn electric capacity altimeter.

The accuracy of the acoustic type instrument is constant with increase in altitude up to the limit of the instrument. This is an improvement over the accuracy characteristic of the barometric type instrument, which is usually more accurate as the altitude increases. The ideal condition, of course, is for improved accuracy at low altitudes.

Acoustic altimeters may well have application on board dirigibles where lift is independent of speed, where engine noises are not present and where sufficient personnel

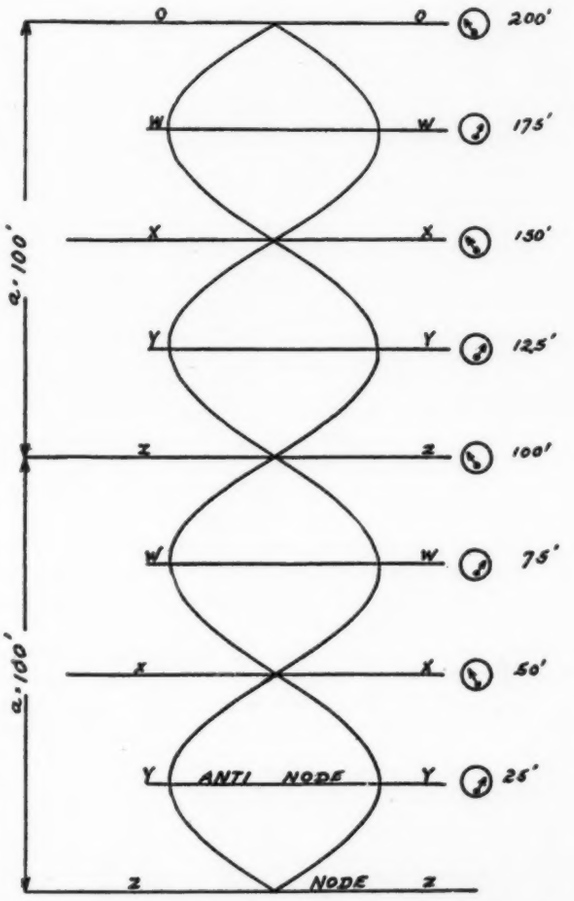


Fig. 2. A drawing illustrating the action of a short wave altimeter. Note how the meter reading changes from maximum to minimum every 25 ft.

can be at hand to operate the device without detracting the attention of the pilot. On airplanes, though, it would seem that a continuously acting automatic device of extreme simplicity is required and none of these features is found in the acoustic apparatus.

The electrical art has offered a rich field for investigators seeking a true altimeter. Nearly all of the efforts have involved the adaptation of radio circuits and phenomena. One of the earliest attempts to make an electric altimeter proposed to utilize what is called a standing wave. This system may be better understood by referring to Fig. 1. In (a) is shown a diagram of a radio wave. It will be noted that in a complete wavelength the wave starts at O, rises to a maximum at WW, becomes a minimum at XX, rises to another maximum at YY and returns again to a minimum at ZZ. For a given trans-

(*Continued on page* 1356)

The "Cavalier" Monoplane

A New Two Passenger Cabin Plane Designed for the Private Owner Is Powered With a Velie 45 H. P. Radial Engine

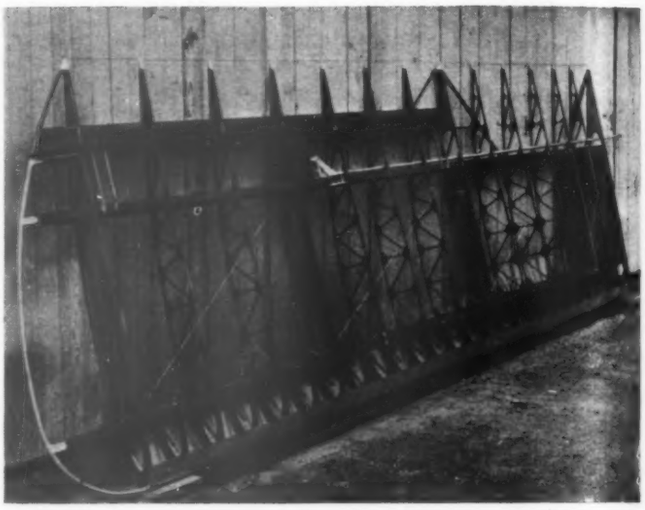
PRODUCTION on the "Cavalier" cabin monoplane is to be started in the near future by the Star Aircraft Co., Bartlesville, Okla. The Cavalier is a two place, externally braced, high wing type of conventional design and is powered with a five cylinder Velie engine developing 45 hp. at 1750 r.p.m. It is intended primarily to be used for business and pleasure by private owners.

The plane was designed by E. A. Riggs, chief engineer of the company, and "Billy" Parker, vice-president and general manager. Successful test flights were held last August and showed the plane to have a maximum speed of 105 m.p.h., a cruising speed of 87 m.p.h. and a landing speed of 38 m.p.h. The rate of climb is 800 ft. per min., and the service ceiling 12,000 ft. During the tests, the plane took off in calm air in 200 ft. and landed under the same conditions in 150 ft. It attained an altitude of 6,500 ft. in 10 min. The plane has a wing span of 31 ft. 6 in.; an overall height of 6 ft. 3 in. and an overall length of 19 ft. 8 in. Its weight, with engine and fully equipped, is 740 lb. The useful load is 575 lb.

No departure from standard practice is found in the general construction of the Cavalier. The fuselage and tail group are welded chrome molybdenum steel tubing and the wing structure is of wood. Both are fabric covered. Routed one piece spruce spars are used with ample fillets at all fitting stations and spruce truss ribs with plywood gussets are employed in the wing construction. Round Macwhyte tie rods are used in the internal bracing. The wing is divided into two panels set at a slight dihedral angle. The spars are connected by heavy gauge tubes

Front quarter view of the "Cavalier" monoplane.

across the top of the fuselage. These tubes are provided with strong lip fittings to receive the spar ends. They lie completely above the longerons and are rigidly attached by welding. Two 13 gal. gasoline tanks are built into the wing roots and the drag stresses in the bays containing the tanks are carried into the fuselage through diagonal grained plywood panels secured to the front and rear spars and to strong box ribs at the ends of the bays.



A photograph of the left wing panel of the new Star cabin monoplane, showing the construction.

A heavy tubular diagonal cross truss in the upper bay of the fuselage takes the drag stresses and at the same time serves as one of the units of a cantilever arrangement which eliminates the necessity of cross bracing in the cabin. A similar unit is used in the lower trussing of the fuselage. Particular attention has been given to the design of the lower fuselage trussing, and the cross tubes are of ample diameter and gauge. This is especially true of the front tube, which is subjected to high compression loads.

The wing struts are built up of a number of chrome molybdenum steel tubes of different diameters, welded at the ends, producing a streamline strut section. Nickel steel screw adjustment fittings are employed at the lower ends of the struts and the fuselage fittings are of chrome molybdenum steel. A single bolt through the spar takes the entire load at each fitting point and is so placed as to eliminate eccentric loading at these points. Another factor, which contributes to the elimination of eccentric loading, is the position of the struts in the same vertical plane as their respective spars. The shear bolts at both strut ends are of government specification nickel steel and are interchangeable.

Standard automobile practice is employed in the interior finish of the cabin, which is upholstered in velour, and has accommodations for pilot and passenger seated side by side. Controls are brought to the left seat, which is intended for the use of the pilot. Good visibility is provided in all directions. Instruments include a tachometer, oil gauge, oil thermometer, and altimeter. A strainer and the shut-off valves for the gasoline line are placed within easy reach of the pilot. Dual controls may be installed

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Commander Byrd's Fokker

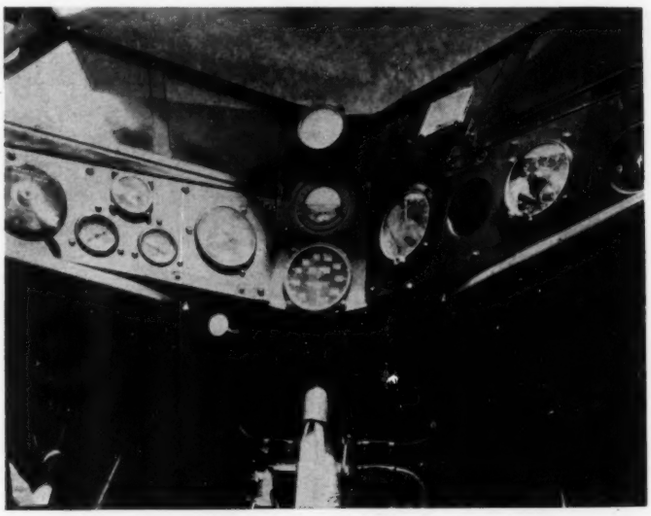
Modified Super-Universal Powered With a "Wasp" Engine Is Fitted With Special Instruments and Equipment

THE "Wasp" powered Fokker Super-Universal monoplane "The Virginia," which will be used by the Byrd Antarctic Expedition, embodies several modifications in the structure of the production plane of this type. Special instruments and equipment not found in the standard Super-Universal have been added to fit the plane for the extraordinary conditions under which it is to be operated. The principal results obtained by these alterations and additions are increased cruising range and greater comfort and convenience for the operators.

Before it was shipped to the Antarctic base, where it is expected to arrive some time in January, 1929, the Virginia was tested at Mitchell Field to the entire satisfaction of Comdr. Richard E. Byrd and his pilots. Previously, the plane was taken on a 25,000 mi. demonstration tour of the country. The Virginia is the fourth Fokker airplane to be purchased by Commander Byrd for his explorations. Its predecessors, the "Josephine Ford," the "America" and the "Friendship," have become internationally famous.

The Virginia employs standard Fokker full cantilever wing construction and has a span of 50 ft., 7 in., an overall length of 36 ft., 7 in., and an overall height of 8 ft., 11 in. The plane has a maximum speed of 140 m. p. h., a cruising speed of 116 m. p. h. and a landing speed of 42 m. p. h. The rate of climb is 1,000 ft. per min. and the service ceiling 18,000 ft. Transparent lacquer, revealing the natural color of the wood, is used on the lower wing surface while the upper surface is finished in chrome yellow. The fuselage is lacquered in Roma Brown.

One of the principal structural changes was made to provide for the installation of two additional fuel tanks, which will provide a cruising radius of nearly 2,500 mi. The fuel system consists of four tanks, three of which are built into the wing and the fourth placed on the floor of the cabin. The total capacity of these tanks is 385 gal., allowing twenty-four flying hours at cruising speed. The center wing tank, which has a capacity of 115 gal., is mounted between the wing spars directly above the cabin and is connected in series with two 95 gal. wing tanks on each side. Glass gauges are provided in the two outer wing tanks, and they are vented from the outside. The center tank is vented by its connection with the cabin tank, which is so designed that it can be filled while the plane is in flight. A hand pump within easy reach of the pilot forces gasoline from the cabin tank into the center wing tank. A small glass gauge in the return pipe acts as a telltale informing the pilot when the tank is full. Shut-off cocks are provided in the connections between the tanks so that it is possible to operate on the center tank alone, the two outside tanks or all three.



The instrument board of "The Virginia," showing the mounting of the instruments for night flying on the narrow panel in the center.

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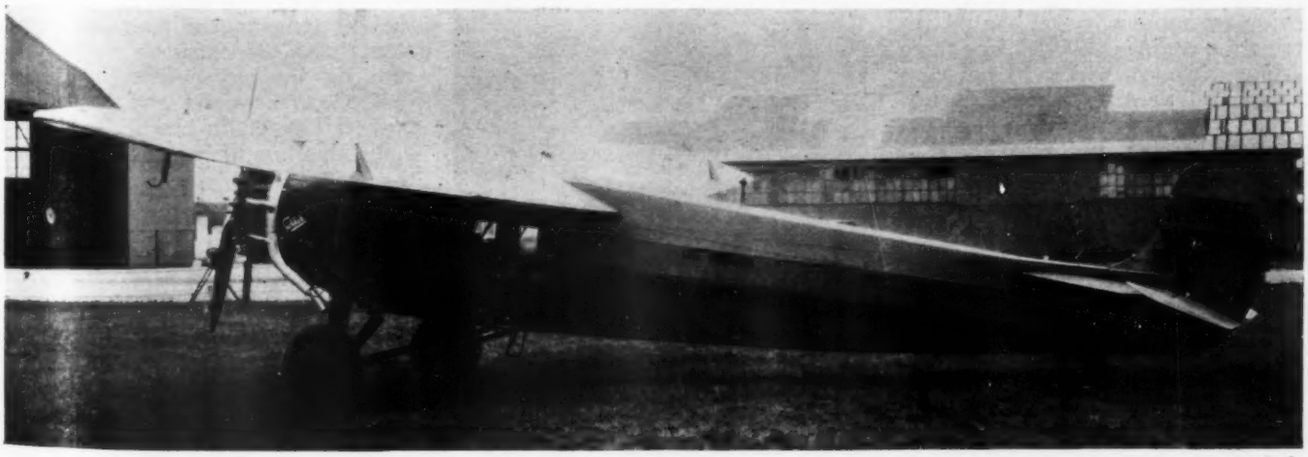


Rear quarter view of "The Virginia," Commander Byrd's modified Fokker monoplane.

Regarding Engine Oil Temperatures

By J. H. GEISSE
Naval Aircraft Factory, Philadelphia, Pa.

THIS article is intended to clear up what seems to be a very wide spread misunderstanding of the significance of oil outlet temperatures, or oil temperature rise in aviation engines. This misunderstanding is not confined to non-technical operators, but is common also among engineers, due no doubt to lack of analysis of the factors controlling the outlet temperature and temperature rise.

One mistake commonly made is that a high oil outlet temperature, or large temperature rise, is an indication of trouble, or poor design. Sometimes it is; but in many cases it is not. Another mistake is the assumption that the oil outlet temperature should be approximately the same for all engines and all installations. Time and time again I have been asked what should be the limit of oil outlet temperature. My answer is that I do not know.

Undoubtedly, there is a limit for each installation, but for different installations of the same engine, or for different engines, this limit may be any where from 120 deg. F. to 240 deg. F., or even higher. The reason for this wide variation in permissible outlet temperatures is that the outlet temperature bears no direct relation to the temperature of the oil in the bearings, or to the heat generated in the bearings, the two values that do have a fairly definite permissible maximum. The analysis that is presented in the following paragraph is designed to show why it is such a direct relationship does not exist.

To simplify the analysis, several assumptions will be made, which deviate fairly far from actual conditions existing in an engine, but I believe that they will affect only the magnitude of influence of the various factors and not the direction of their influence. The major assumption is that the oil entering the engine is divided into three distinct channels which do not converge until they reach the scavenge pump. One channel will lead to the crankpin bearing, and from there to the pistons and cylinder walls, and will then contact with a section of the crankcase on its return to the scavenge pump. A second channel will lead to the auxiliary and main bearings, and contact with a different section of the case on its return. The third channel will lead through the relief valve and no heat will be added to, or subtracted, from this channel.

When the three channels converge, their temperatures are equalized and the mean thus obtained is the oil outlet temperature. The oil outlet temperature can then be set down in the following equation:

$$T_o = \frac{W_1T_1 + W_2T_2 + W_3T_3}{W_1 + W_2 + W_3}$$

in which

T_o=outlet temperature.
W_1=rate of flow in channel No. 1.
T_1=final outlet temperature channel No. 1.
W_2=rate of flow in channel No. 2.
T_2=final outlet temperature channel No. 2.
W_3=rate of flow in channel No. 3 (relief valve).
T_3=inlet temperature.

Now let us consider the heat interchanges in channel No. 1. The rate of oil flow through the bearing will not materially change the friction, so it can be assumed that the amount of heat absorbed will be independent of oil flow. This being the case, the temperature of the oil leaving the bearing will be equal to the inlet temperature plus some constant, divided by the rate of flow. This oil will then strike the cylinder walls and pistons. Here, the amount of heat absorbed will increase with increase of oil flow at the expense of heat dissipated by the cylinder cooling means. We will make a rather bold assumption that the temperature of the oil leaving these parts will bear a definite relation to the metal temperature and, therefore, the heat units added to the oil in unit time will vary directly with the rate of flow. In passing over the crankcase wall, a certain amount of heat will be dissipated, and the amount will vary as the difference of the oil temperature (assumed constant) and the outside air temperature, the air velocity over the crankcase, the area wetted, and the rate of flow. However, in practically all engines, this loss of heat will not equal the gain. It is obvious, therefore, that there will be a temperature rise in this channel.

J. H. Geisse

It should be noted here that the heat generated in the crankpin bearing will have very little direct effect on the final heat content in this channel. It will, however, have somewhat of an indirect effect, in that the reduction in viscosity of the oil associated with the higher temperature in the bearing will increase the rate of flow in this channel and there-

fore more heat will be taken from the pistons. It should also be noted that the temperature of the oil in the bearing is not related directly to the final temperature in this channel but does have a fairly close relationship to the oil inlet temperature.

Next consider the oil in the second channel. It likewise receives a definite amount of heat from the bearings, and the temperature leaving the bearings will be equal to the oil inlet temperature plus a constant divided by the rate of flow. This oil in passing over the crankcase will lose an amount of heat proportional to the difference in the temperature of the oil and the air, the wetted area, the air velocity, and the rate of oil flow. In any engine operating with no final increase in oil temperature, it is apparent that this oil must accomplish a total dissipation of heat equal to the amount added to the oil in the first channel, since the oil in the third channel has no heat interchange.

An Important Item

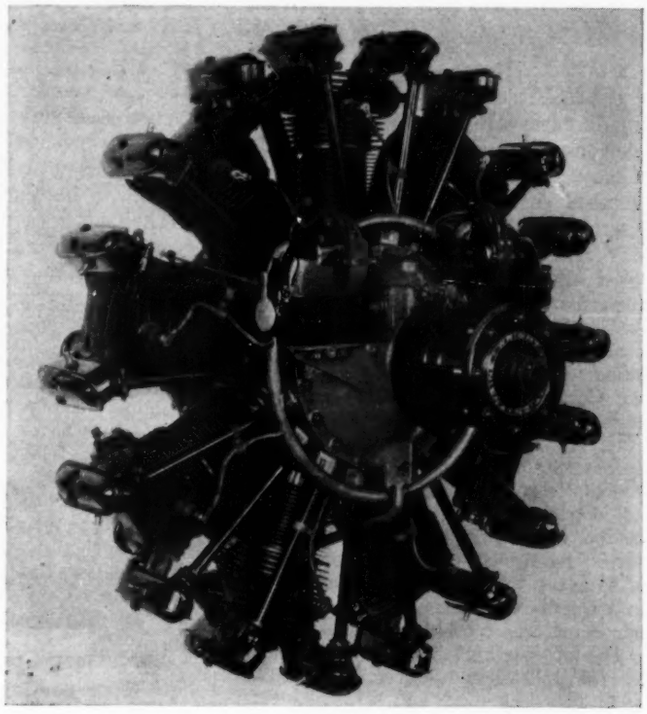
Now let us consider the effect of various variables on the oil outlet temperature and the temperature rise. An increase in the rate of flow through the relief valve, without any other change, will reduce the outlet temperature without altering the temperature at the bearings. This is an important item. Engines having a low oil flow through the relief valve, such as the Liberty, will have a greater oil temperature rise than engines like the Wright T-3, having a much larger relief flow, other things being equal. Engines like the Le Blond, in which the oil from the relief valve goes back to the suction side of the pressure pump, giving no oil in our channel No. 3, will have a greater temperature rise than will a Wright "Whirlwind," if other factors are alike. It is quite apparent then, that these engines will all require different temepratures of the oil outlet in order to secure the same temperature at the bearings.

Again let us assume two air cooled engines alike in all respects, including total rate of oil flow, but with a different ratio of flows in channels No. 1 and No. 2. That one, having the greatest flow through channel No. 2 will have the lower temperature rise because channel No. 2 tends to dissipate heat and channel No. 1 to absorb heat. This is an item worthy of special consideration. In most installations of air cooled engines, it is desirable to avoid the necessity of an oil cooler, depending on the radiation from the engine and tank to dissipate all of the heat. It is quite possible, that in cases where this has not been achieved, that a slight change in the oil system of the engine allowing a greater flow to the accessory drives would have accomplished the desired result. It is also possible that oil temperature regulation in air cooled engines might be secured by regulation of the flow in the second channel, thus making adjustable cowling unnecessary.

The Effect of Detonation

Another point of interest in this division of flow is in the effect of detonation. Although I am not sure, I am inclined to believe that the oil temperature is sometimes used as a guide in the choice of fuels for air cooled engines. If this is the case, it is evident that that engine having the greatest flow to the pistons and cylinders will show the greatest increase in oil temperatures due to detonation and may possibly be considered as more inclined to detonation that an engine less sensitive. On the other hand the engine having the least sensitivity may be abused by the use of a fuel causing considerable detonation.

Now let us consider changes that may occur in an engine in service. In an air cooled engine installation having no oil cooler, or other means of oil temperature regulation, an increase in bearing clearances in channel No. 2 will result in a decrease in oil temperature. An increase in the connecting rod bearing clearance will result in just the opposite effect, as explained in a preceeding paragraph. An increase in oil pressure will increase the rate of flow in both channels No. 1 and No. 2. The result may be an increase, or a decrease, in temperature rise.



Front quarter view of the 200 hp. Wright "Whirlwind" air cooled radial engine referred to in this article.

To determine which would be the case, would require a closer analysis of the heat exchanges in these channels than I have made. In water cooled engines, it would without question result in an increase, the extent of change being dependent on the relative amount of heat normally taken from the bearings and the pistons. A decrease in viscosity of oil used will act in the same way as a change in pressure.

In engines in which the oil from the relief valve is led to the inlet of the pressure pump, it is quite possible that too low an inlet temperature will result in too high an outlet temperature. This may occur also in engines having pumps, whose capacity varies considerably with viscosity and pressure head. In either case, the decrease in flow will result in a decrease in total heat taken from the engine. If this decrease is not sufficient to compensate for the lower flow rate, there will be of necessity an increase in temperature rise. If the increase of temperature rise is more than sufficient to balance the decrease in inlet temperature, then it readily will be seen that the outlet temperature will increase as the inlet temperature is decreased.

In conclusion I would like to say that although this entire article has been drafted to show that the temperature of the oil at the bearings does not have a definite relation to oil outlet temperature, I do not contend that the outlet temperature has no significance. It has, very definitely, but not as much as some operators are inclined to believe and variations in it must be analyzed much more thoroughly than has been generally done. A thorough analysis may save a considerable amount of work and worry for operators of aircraft engines.

Chicago Aeronautical Show Exhibitors Are Announced

Space in Great Demand for Materials, Parts, and Accessories Display

CHICAGO, ILL.—Thirty-four aircraft manufacturing companies have made reservations of space for 62 airplanes for display in the International Aeronautical Exposition to be held under the auspices of the Aeronautical Chamber of Commerce of America in the Coliseum and First Regiment Armory here from December 1 to 9, according to bookings received through October 18. Eleven corporations manufacturing aircraft engines had asked for space in which to exhibit 27 power plants of various types and sizes. Sixty-five corporations making accessories, materials, or supplies used in the construction of aircraft, engines, parts, or equipment, had reserved the entire complement of 87 booths. When the Exposition was announced, it was thought that the Coliseum would be adequate to care for all the exhibitors. The demand, however, has astonished the industry. It has forced the leasing of the First Regiment Armory and may require the leasing of additional space if such is possible to obtain. The demand for booths by accessories, parts and material manufacturers is so heavy that the show management is in a quandary as to how to care for this important branch of the industry.

The airplane exhibits range in size from tiny single seaters to three engine transports, of which there will be possibly half a dozen on display. The planes to be shown in Chicago come from all parts of the United States, including Ohio, Pennsylvania, Colorado, Missouri, Kansas, New York, Michigan, Maryland, New Jersey, Illinois, California, Oklahoma, Arkansas, and Washington.

The exhibitors in the accessories and miscellaneous class range from manufacturers of spark plugs and clothing to hangars and field lighting equipment.

A partial list of exhibitors, as of October 18, is as follows:

Report Number of Planes

Aircraft—Advance Aircraft Co., number of planes as yet not announced; Aircraft, Inc., two planes; Alexander Aircraft Co., one plane; American Eagle Aircraft Co., three planes; Buhl Aircraft Co., two planes; Cessna Aircraft Co., two; Consolidated Aircraft Corp., three; Driggs Aircraft Corp., one; Fairchild Aviation Corp., three; Kreider-Reisner Aircraft Co., one; Pitcairn Aviation, Inc., one; National Air Transport, Inc., one; Stinson Aircraft Corp., two; Gates-Day Aircraft Corp., one; Laird Airplane Co., three; Swallow Airplane Mfg. Co., one; Chance Vought Corp., one; Keystone Aircraft Corp., three; Mohawk Aircraft Corp., two; Travel Air Mfg. Co., three; Atlantic Aircraft Corp., three; Curtiss Aeroplane & Motor Co., three; Ford Motor Co., two; Hall Aluminum Aircraft Corp., one; Ryan Aeronautical Corp., two; Rhinehart-Whelan, one; Simplex Aircraft Corp., one; Stearman Aircraft Corp., two; Tidewater Oil Sales Corp., one; Spartan Aircraft Corp., two; Phanton Knight Aircraft Co., one; Command-Aire, Inc., two; Aeromarine-Klemm Co., two; Boeing Airplane Co., two.

Engines—Aeronautical Products Corp., three; Brownback Motor Laboratories, Inc., one; Fairchild Aerial Camera Corp., two; K. G. Frank, three; Spartan Aircraft, one; Pratt & Whitney Aircraft Corp., four; Wright Aeronautical Corp., four; Simplex Aircraft Corp., two; Curtiss Aeroplane & Motor Co., three; Warner Aircraft Corp., two; Michigan Screw Co., two.

Accessory Companies Named

Accessories and Miscellaneous — AC Sparg Plug Co., plugs; Aero Digest, publication; Aero Guides, airway marker; Aero Model, airplane models; Aero Supply Mfg. Co., parts; Aerovane Utilities Corp., markers; Airway Age, publication; American Airports, model airports; Arens Patent Control, airplane controls. Aviation Publishing Corp., publication; Bendix Brake Co., brakes, wheels; Berry Brothers, paints and dopes; Black & Decker, tools; Sidney Blumenthal & Co., fabrics; Bohn Aluminium & Brass Corp., aluminium and brass products; Canvas Leather Specialty Co., leathers; Crouse Hinds Co., airport lighting; Eclipse Machine Co., starters; Electric-Storage Battery Co., exide batteries; Elgin National Watch Co., instruments; Fairchild Aerial Camera Corp., aerial surveys; Globe Superior Clothing Co., clothing; Johnson Airplane & Supply Co., supplies and parts; Irving Air Chute Co., parachutes; Kendall Refining Co., fuel and lubricants; Leece-Neville Co., electrical prod. and lubricants; Macwhyte Company, flying wires; Norma-Hoffman Bearings Corp., bearings.

Many and Varied Displays

Pioneer Instrument Co., instruments; Popular Aviation, publication; Pyrene Mfg. Co., fire extinguishers; H. H. Robertson. model hangars and ventilators; Roebling Sons, Co., John A., aircraft cables; New Departure Mfg. Co., bearings; Scintilla Magneto Co., magnetos; B. Russell Shaw Co., model airports; S K F Industries, bearings; Stromberg Motor Devices Co., carburetors; Summerill Tubing Co., tubings; Timken-Roller Bearing Co., bearings; E. S. Twining & Co., fabrics; Vacuum Oil Co., lubricants; Vellumoid Co., fabrics; Western Flying, publication; Westinghouse Lamp Co., lamps; Wyman Gordon Co., forgings; B. B. T. Corporation, airport lights; Bosch Magneto Co., magnetos; Chilton Class Journal, publication; General Electric Co., electrical parts; Goodyear Rubber Co., tires and tubes; Pennsylvania Railroad, exhibit not announced.

Haskelite Mfg. Corp., plywood; Rand McNally & Co., aerial maps; Standard Oil of Indiana, fuel and lubricants; Westinghouse Electric Co., electrical accessories, Goodrich Rubber Co., tires; Posey Mfg. Co., screws; Aluminum Co., of America, aluminum parts; Airports, publication; Air Transportation, publication; J. C. Hoof & Co., piston rings; Taylor Instrument Co., instruments; Follmer Clogg & Co., parachutes; Airships, Inc., exhibit not announced.

Russians to be At Conference

WASHINGTON, D. C. — Though Soviet Russia was not included in official invitations to the International Civil Aeronautics Conference scheduled here December 12-14, unofficial delegates will be sent, it is reported. Representatives of the private and volunteer aeronautical organizations of Russia, known, respectively, as the Debrolet and Oseviakhim, will attend, says T. M. Pavloff of the Armtog Trading Corp., commercial Russian agency with headquarters in New York.

Bendix Buys Interest In Eclipse Company

ELMIRA, N. Y.—Majority interest in the Eclipse Machine Co. of this city has been purchased by the Bendix Corporation of Chicago from the General Motors Corp., it is announced. The last named organization had obtained the Eclipse interest a short time ago from the Edward J. Dunn estate.

Vincent Bendix of the Bendix Corporation is interested in many manufacturing concerns, including the Bendix Brake Co. of South Bend, Ind., which makes airplane wheels and brakes. The Eclipse company will be continued in Elmira under its own name.

Eaglerock for Yukon

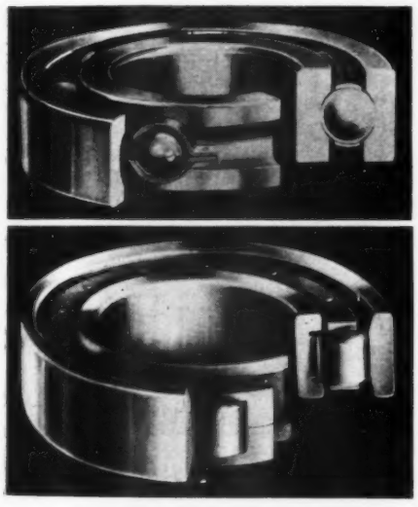
COLORADO SPRINGS, COLO.—Clyde Wann and Pilot J. H. Patterson recently completed a 15,000 mile flight from here to the Yukon, delivering a Whirlwind powered Eaglerock plane to the Yukon Airways and Exportation Co. The craft will be used on the regular run of the firm.

S K F Bearings Used in Zeppelin

Letter Tells of Their Application to Mechanical Equipment

NEW YORK, N. Y.—A letter explaining the location and application of S K F ball and roller bearings in the engines and other mechanical equipment of the Graf Zeppelin was made public recently by S K F Industries, Inc. This letter, which was included in the mail carried by the dirigible on its transatlantic flight, was addressed to the New York offices of the company and sent by its sister firm in Germany.

The letter in part reads as follows: "Both electric lighting generators are equipped with S K F thrust bearings. One of these generators is driven by a propeller and the other by a gasoline engine. Both radio generators, which are driven



S K F ball (upper) and roller (lower) bearings cut away showing construction.

in the same way as the lighting generators, are equipped with S K F thrust bearings.

"The spindle of the bow anchor, which is used to fasten the ship to the mooring mast, is equipped with two S K F cylindrical roller bearings and two-direction thrust bearings. Many other machines, such as the generator for heat, measuring apparatus, and stabilizing equipment, are also equipped with S K F bearings which also are used for the propeller shafts in the gondolas."

An itemized list of the bearings used in each of the five 12-cylinder Maybach engines is also included. These bearings are distributed as follows:

Twelve roller bearings, developed in cooperation with the Maybach Motor Co., are used in the connecting rods. Seven main roller bearings and one ball thrust bearing are used for the crankshaft. In the rocker arm assembly 48 roller bearings are employed and 14 roller bearings are utilized for the control shafts. The water pump is equipped with one ball and one roller bearing and one ball and two roller bearings are used in the starting air compressor. Eight roller bearings are used in the drive of the ignition generator.

The excellent performance of the engines during the flight from Germany to America is attributed largely to the efficiency of the bearings in the power plant.

Auto Dealers Sell Airplanes

LOS ANGELES, CALIF. — Something of the trend in new airplane dealer organizations is revealed by a recent questionnaire sent out by the Aero Corporation of California. Answers showed that 65 per cent. of their dealers were actively engaged in automotive industry one year ago and that 30 per cent. of these are still automobile dealers, having acquired an airplane sales franchise with the intention of selling both airplanes and automobiles from the same show room floor.

Named Pan American Agent in Orlando, Fla.

ORLANDO, FLA.—Affiliation of the Nilson-Mueller Corp. with Pan American Airways, Inc., as local representative in an Orlando-Havana-Porto Rico air line venture, is announced. Decision to establish an agency here came after a study of business prospects and a survey of the new municipal airport, called one of the foremost in the South.

According to the plan, Pan American Fokker planes will fly from Miami to care for passenger and express business placed through the Nilson-Mueller firm whenever the demand is sufficient. In case less than a full load request is received, the local operator will fly passengers and express to Miami to connect with the regular Pan American service to Cuba and Havana. Nilson-Mueller is Florida Waco distributor.

MacDonald Believed Lost

ST. JOHN'S, NEWFOUNDLAND.—Little hope is held out for Lieut. Comdr. H. C. MacDonald, who flew east on October 17 in an attempted trans-Atlantic flight in a Gipsy Moth plane. A steamer reported the flier some 700 mi. east of Harbor Grace eight hours after he took off, but no further word was received.

Circus Features Ohio Meet

ST. MARYS, O.—The Crabill flying circus featured the American Legion Aviation Meet staged here October 21. Ten planes participated in the maneuvers.

To Build Cirrus Engines in U. S.

Banking Syndicate Also Buys Exclusive Distribution Rights

NEW YORK, N. Y.—Purchase of exclusive American sales, manufacturing, and distribution rights for the Cirrus airplane engine by a banking syndicate headed by Campbell, Peterson & Co., Inc., is announced, and according to plans now underway, a factory will be erected in this country to build the power plant. The Cirrus engine is manufactured in London by Cirrus Aero Engines, Ltd., and is used in the DH Moth, the Avro Avian, Westland Widgeon, Short Mussell, and other light craft.

Established success of the Cirrus power plant as demonstrated in its operation over the last two and one-half years brought Campbell, Peterson & Co. to negotiate for the American rights, according to Col. R. Potter Campbell, chairman of the board. "We have made a thorough investigation of the engine's merit," he said, "and we consider it a splendid addition to the American market."

The three principle engines produced by the Cirrus company are the Cirrus Mark I four-in-line air cooled plant of 60 hp., the Cirrus Mark II, which was built to meet the demand for an engine of higher power, enabling takeoffs of light planes in more restricted areas, and the Cirrus Mark III four-in-line 95 hp. plant, a still more highly powered engine.

Many Cirrus engines have already been sold in the United States, and it is reported that more than 2,500 applications have been made to the banking syndicate for agencies.

Brooklyn Firm Plans To Build Light Planes

BROOKLYN, N. Y.—Manufacture of light planes similar to the English types to sell for $2,500 will start here by January 1, according to an announcement made today.

Experimentation with a two-cycle engine in Newark laboratories under the supervision of Frank Engel has been going on for the past three months. State Senator John A. Hastings is heading the project and contemplates production soon.

Installation of a two-cycle engine in a light plane for flight experiments will be completed shortly.

Curtiss Starts Buffalo Plant

BUFFALO, N. Y.—Ground was broken recently for the new $7,000,000 plant of the Curtiss Aeroplane & Motor Corp.

Plan to Produce "Skyway" Biplane

Butler Aircraft Corp. to Manufacture Whirlwind Powered Craft

KANSAS CITY, MO.—Following the recent test flights of the "Skyway," the first plane to be built by the Butler Manufacturing Co., plans were made for production of the plane by the Butler Aircraft Corp., a newly formed subsidiary. The trial flights were made at Fairfax Field by Howard Jones, test pilot, and were witnessed by several hundred persons including Waverley Stearman, designer of the plane.

The Skyway is of conventional design and construction, having a welded steel tube fuselage, wood wing structure, and fabric covering. It is powered with a Wright Whirlwind J-5 engine developing 200 hp. at 1800 r.p.m. The overall length is 23 ft., the upper wing span 34 ft. and the overall height 10 ft. The weight empty is 1650 lb. and the useful load 1050 lb. The actual pay load is 450 lb. With full load the high speed is 130 m.p.h., the cruising speed 110 m.p.h. and the landing speed 42 m.p.h. The rate of climb is 1400 ft. per min. and the service ceiling 14,000 ft

Instruments include an air speed indicator, altimeter, tachometer, oil temperature and pressure gauges, compass and clock. A fire extinguisher, navigation lights and a Standard Steel propeller are included in the equipment. Dual stick control is provided and the plane has a gasoline capacity of 65 gal. and an oil capacity of five gallons. Landing gear is of the split axle type with oleo shock absorber struts and has a tread of seven feet. The wheels used are 28 in. by 4 in. in size. A new type of oleo tail skid is also provided.

According to an announcement by E. E. Norquist, president and general manager of the Butler Manufacturing Co., the company plans production of plane parts as well as planes. Future plans call for the development of all metal planes. The next Skyway to be built will be a four passenger cabin plane. Design work on this new model already has been started.

Army Orders Eight Loenings

NEW YORK, N. Y.—Contract for eight of the new type observation amphibian planes has been awarded to the Loening Aeronautical Engineering Corp. of New York City by the U. S. Army Air Service. It is understood that these craft will be powered with a new air cooled eight-in-line engine, although no details of this power plant have been made public.

Announcement of this order followed statements of the Loening company's merger with the Keystone Aircraft Corp. of Bristol, Pa., details of which are given elsewhere in this issue of AVIATION.

Travel Air Develops Experimental Plane

WICHITA, KAN.—Travel Air, Inc., of Wichita, has developed a new type of biplane which is termed the "bug" around the factory. It is similar to the standard three-place Travel Air OX-5 powered plane, except that the fuselage is five inches narrower. This gives it a speed of about 120 m.p.h, or 20 to 25 m.p.h faster than the standard craft.

The plane is purely experimental, factory officials point out. Production of a new type depends upon the prospective market. It is a two-place plane suitable for training purposes and racing.

Set Date for Detroit Show

DETROIT, MICH.—The second annual All-American Aircraft Show will be held in Detroit from April 6 to 14, inclusive, it was announced recently by the All-American Aircraft Show Committee of the Detroit Board of Commerce Aircraft Bureau. Edward S. Evans, chairman both of the Bureau and the Committee, stated that the Detroit Adcraft club will handle the publicity and promotion work.

A front quarter view of the Whirlwind powered "Skyway" biplane which is to be produced by the Butler Aircraft Corp.

To Build Fokker Planes in England

Canadian Vickers, Ltd., Gets Dominion Manufacturing Rights

HASBROUCK HEIGHTS, N. J.—That the manufacturing rights of Fokker commercial aircraft have been acquired by A. V. Roe, Ltd., Manchester, England, is announced by Anthony H. G. Fokker, of the Fokker Aircraft Corp., here. These rights are to apply for Great Britain and British Possessions except Canada. A manufacturing contract for the Dominion, on the other hand, has been closed with Canadian Vickers, Ltd., of Montreal.

The Canadian factory, it is said, will start manufacture immediately of the 14 passenger Fokker F-10 monoplane, the six passenger Fokker Universal, and the eight place Super-Universal.

A considerable number of Fokker planes have been employed during the past two years by Western Canada Airways of Winnipeg in transportation operations in the gold field areas and Hudson Bay districts, while the Hudson Straits Expedition, operated by the Canadian Government to investigate Straits navigability, was also equipped with Fokker craft.

These planes were flown north from the United States, but continued demand now calls for manufacture in Canada. The American plants are now fully occupied with commercial orders running into several million dollars, officials says.

No details of the plans of the A. V. Roe, Ltd., have been given out at this writing. This firm makes the Avro Avrian light plane.

Graf Zeppelin in Trip Through Middle West

LAKEHURST, N. J.—As we go to press, reports here state that the Graf Zeppelin is scheduled to leave Thursday October 25 for its flight to the Mid-West, with a return to Lakehust planned the following day. Advices say that the dirigible will fly by way of Pittsburgh, Columbus, Cincinnati, and Indianapolis to St. Louis.

Continuing to Scott Field, Ill., the airship will be held overnight at the latter aircraft base, then Friday the Zeppelin will go on to Chicago, Milwaukee, Detroit, Cleveland, Akron, Buffalo, Niagara Falls, Syracuse, Albany, New York, and back to Lakehurst.

Command-Aire Expands

LITTLE ROCK, ARK.—An increase in capitalization from $100,000 to $1,000,000 as a first step toward boosting production from three to eight planes per week is announced by Command-Aire, Inc., formerly the Arkansas Aircraft Corp.

Travel Air to Try New System of Distribution

WICHITA, KAN.—A new system for distributing airplanes, with a plan for the two leading salesmen to be in the field continuously with airplane demonstrators, is announced by Travel Air, Inc. Roy W. Brown of Detroit has been employed as sales representative in charge of the vast territory between Cleveland and Denver, and from the Canadian to the Mexican Border. The eastern territory will be in charge of O. G. Harned, sales manager of Travel Air the past three years. His headquarters will be in Albany, N. Y. Later a sales manager will be selected for the western territory.

Brown has just left Wichita in a Hisso-powered biplane to call on dealers at Kansas City, St. Louis, Chicago, Moline, Milwaukee, Minneapolis, Omaha, Denver, Joplin, Memphis, Indianapolis, Columbus, Cleveland and Detroit.

Brown and Harned, who combine the qualities of salesman and pilot, will work in conjunction with distributors and dealers in their territories, while all will be directly responsible to Walter Beech, president of the company.

Brown has been engaged in aeronautical pursuits for more than 10 yr., being in Government service for some time. In 1921 he gained a "gold wing" certificate from the War Department, showing that he had served 200 continuous hours in instruction duty.

Ten Colleges Banded At Yale Conference

NEW HAVEN, CONN.—Ten universities were represented in the formation of the National Intercollegiate Aeronautic Association here on October 20. These were Yale, Harvard, Pennsylvania, Cornell, M.I.T., Carnegie Technical Institute, Illinois, Northwestern, New York University, and Detroit University. Aero clubs of these colleges will keep in touch with each other in the promotion of aviation. Grover Loening, Amelia Earhart, and Senator Hiram Bingham were among the speakers, all of whom urged development of the science of aviation through the universities. Mr. Loening told the group that he was forced to withdraw the cup he donated for college races until later because the Harvard club was the only one with sufficient training to enter at the present time.

Roller-Smith Names Agent

DETROIT, MICH.—Appointment of Wise & Braisted, General Motors Building, Detroit, as district sales agent in the State of Michigan, is announced by the Roller-Smith Co., New York City.

Fifty Register for Course

BUFFALO, N. Y.—Fifty persons have registered for the aviation course being given at the University of Buffalo.

Start Expansion Of Kinner Firm

GLENDALE, CALIF.—Capital stock of the Kinner Airplane and Motor Corp., Glendale, Calif., was recently increased from $100,000 to $600,000. An attendant expansion of factory facilities is expected to accomplish a production of 50 engines per month within the next 90 days, according to the announcement of W. B. Kinner, president.

Record Attendance At Teterboro Show

HASBROUCK HEIGHTS, N. J.—A record attendance was reported at the Second National Airplane Show and Air Circus held October 20-21 at Teterboro Airport by the Gates Flying Circus and Aviation Corp., for the benefit of the Elks Crippled Kiddies Fund. On Sunday, the second day of the show, more than five thousand persons were present.

The feature event was the attempt of Mrs. Martha Bevins, 18 year old aviatrix and wife of Pilot Okey Bevins, to break the endurance record for women. Mrs. Bevins made two flights but in both attempts was forced down by engine trouble.

Included in the program were formation flying, parachute jumping, wing walking, balloon strafing, a dead stick landing contest and a demonstration of delivering and picking up a mail sack by a plane in flight. Among the participating pilots were Clyde E. Pangborn, Wilmer Stultz, Ivan R. Gates, Okey Bevins, Jess Menefee, Bill Grey, Charles "Slim" West, Grissom E. Haynes, Capt. Earl White, Leon Allen, Hughie Wells, Ive McKinney, Jimmie Taylor and Errole Bohl.

Among the planes exhibited were: Fokker F-10, F-7, Standard Universal, Super Universal; Gates-Day New Standard, GD-24; Ford Tri Engined Transport, Waco, Travel Air, Challenger, American Eagle, DH Moth, Lockheed Vega, Stinson Detroiter and Avro Avian.

Dyer Wins Schiff Trophy

WASHINGTON, D. C.—With a record of 1,251.15 hr. in the air during the fiscal year 1927-28 without accident to plane or personnel, Lieut. James E. Dyer, Navy pilot, has won the Herbert Schiff Memorial Trophy, awarded each year to the naval aviator who flies the greatest number of hours without accident. Schiff is stationed at San Diego.

First Challenger Travel Air

WICHITA, KAN.—A new Curtiss Challenger engine has been installed in a Travel Air for the N. R. Airways of Mineola, Long Island. It is the first Challenger-engined Travel Air sent out from the Wichita factory.

Keystone-Loening Merger Reported

Both Plants Will Continue Operation as Independent Units

NEW YORK, N. Y.—Through the exchange of all the outstanding shares of the Loening Aeronautical Engineering Corp. of this city for shares of the Keystone Aircraft Corp. of Bristol, Pa., arrangements for the merger of these two firms have been made, according to Richard F. Hoyt, a member of the firm of Hayden, Stone & Co. and chairman of the board of the Keystone company.

It is planned, the report states, to continue the operation of both plants as independent units, thus preserving to the resulting organization the benefits of the Loening corporation. Since the products manufactured by the Keystone and Loening companies have at no time been competitive, the combination is a strong one with products distributed in both Governmental and commercial markets.

The Keystone Aircraft Corp., originally organized in 1920, has developed its business largely as a supplier of military planes to the United States Army and Navy and foreign governments, its present product consisting primarily of large bombing craft and training planes. The corporation is now completing the development of the "Patrician," a large air transport, which will be its first commercial product, and is expected to meet the demands of the rapidly growing air transport lines.

Loening Firm One of the Oldest

The Loening Aeronautical Engineering Corp. is one of the oldest and most successful airplane manufacturing enterprises in the United States. It was organized in 1917, and since that time has been directed by Grover Loening and his brother, Albert Loening. In addition to its long record of achievements in Government service, including many world's records and expeditions such as the Alaskan Survey, Pan-American flight, etc., the Loening corporation was among the first to build planes commercially and for private owners. Among the earlier types of Loening planes is found the development of the braced monoplane of the type that has since been widely constructed.

Rebuilding Service Planes

BROOKLYN, N. Y.—With a plant established at Mill Basin, adjacent to the new Barren Island municipal airport here, the Brooklyn Air Transport, Inc., is now rebuilding U. S. Government planes for sale to the public. Construction of new airplanes by the company will begin by December 1, according to Edward Wengenroth, president.

Mahoney-Ryan Tests Monoplane

New Low Wing Craft Embodies Many Original Features

SAN DIEGO, CALIF.—A new type of monoplane embodying several unique features, has been designed for the Mahoney-Ryan Aircraft Corp., by Donald A. Hall and W. L. Schult, experimental engineers, according to a recent announcement. The plane was recently completed and put through a series of tests.

The new airplane is a two passenger, low wing type with a span of 27 ft. and a length of 22 ft. It is intended primarily for training purposes. The wing is set at a dihedral angle of 5 deg. and in landing position the wing forms an angle of about 22 deg. with the ground. It is said that its landing run is less than 150 ft. The plane is also characterized by its exceptionally wide landing gear tread.

Has No Stabilizer

The most radical change in the new monoplane is the absence of a stablilizer, heretofore considered an absolute necessity. Nor has this plane a fin. Control is made possible through the use of a moveable wing in back which acts as an elevator. This is about half the size of the wing and is several times the size of the usual elevator. A large rudder completes the easy handling features and makes the plane delicately responsive.

Development of safety features is said to be the prime motive in the new monoplane. For instance a "gear shift" has been installed, according to reliable information, which is comparable to that in the automobile. A change from one gear to another will transform the plane from a standard flying plane into a stunt plane. During the tests the plane was put through a number of maneuvers.

Short Wing Used

A much shorter wing spread on this new monoplane is noted than that of the usual monoplane with the same carrying capacity. This is a distinct advantage toward size reduction which is one of the aims of engineers. In direct proportion this increases the efficiency of the plane.

Menasco Lifts 8,232 lb. Load

OAKLAND, CALIF.—Proof of ability to lift heavy loads was shown recently by the 260 hp. Menasco-Salmson powered Timm biplane when Capt. Roscoe Turner and Jack Rand took the craft off the field with the total load put at 8,232 lb. at the start of a fruitless endurance attempt.

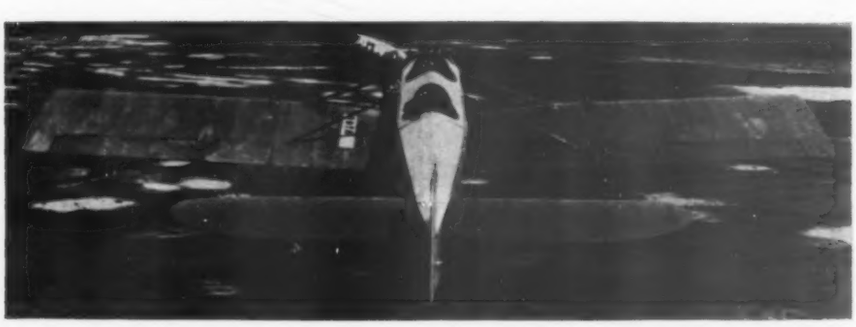
Detroit Firm to Sell Engineless Aircraft

DETROIT, MICH.—An organization headed by William J. Scripps, son of the vice president and managing editor of the *Detroit News,* and including in its directorate Edward A. Stinson, Alfred V. Verville, and Eddie Rickenbacker, recently announced formation of Gliders, Inc., a firm whose function will be to manufacture and sell engineless aircraft in Detroit. Gliders, Inc., will be the first concern of its kind in the Detroit area and one of the few existing outside Germany.

The new company is capitalized for $37,500. Negotiations for a factory site near Rochester, Mich., 25 mi. north of here, are underway. The initial production plans call for construction of 25 gliders of three types—primary trainers, secondary trainers, and soarers. The engineless craft will be designed similar to the Darmstadt type, now used extensively in Germany. Engineering work will be in charge of Tom Towle, Detroit aeronautical engineer. It is hoped to complete the first glider within a period of four or five weeks. The new company has entered an agreement with the newly formed Glider Clubs of America.

Form Radio Aircraft Corp.

ST. LOUIS, MO.—Recently incorporated for $50,000, the Radio Aircraft Corporation of Missouri is a subsidiary of radio station WIL. The company has obtained an 80 acre tract on the Johnson Road in the northern section of Granite City, Ill., on which it proposes to erect hangars and buildings for offices and school. L. A. Benson is the president.



Rear view of low wing monoplane having neither stabilizer nor fin. This craft was recently built and tested by the Mahoney-Ryan Company.

New Vought Airplane Tested by Air Corps.

WASHINGTON, D. C.—The Army Air Corps Test Board, under Maj. James E. Fechet, chief of the Air Corps, recently put the new Vought O2U-2 Observation-Diving Bombing attack plane through its paces at Bolling Field, Washington, D. C.

Among the pilots of the Army Air Corps who flew this newest Vought model, were Capt. Frank Hunter, Capt. H. M. McClelland, Capt. G. E. Brower, Capt. St. Clair Streett, and Capt. Robert G Breene, as well as Maj. Horace M. Hickhan of the General Staff Corps.

The entire Board and all the Army pilots who flew the plane were enthusiastic over the performance and handling qualities of the new "Corsair" and were impressed with the visibility afforded.

A large order for these new "Corsairs" (Model O2U-2) is now being filled at the Vought plant in Long Island City, for the use of the U. S. Navy. These planes are being fitted with the original Vought amphibian gear which is interchangeable with the non-steering wheel-type landing gear developed by Vought, and the standard float gear, making them what might be called a "universal" type plane.

This new Vought, like the original "Corsair" which still holds four World performance records for speed and altitude with load, is designed around the Pratt & Whitney Wasp engine of the new R-1340-B series.

Phoenix-Los Angeles Race to Be Instituted

PHOENIX, ARIZ.—A Phoenix to Los Angeles air race with prizes sufficient to attract leading aviators was definitely decided upon by the Chamber of Commerce as the leading feature of the dedication of the Phoenix Municipal Airport to be held Feb. 2, 1929. C. F. Lienesch, manager of technical relations of the Union Oil Co. of California, who had been asked to help the Chamber arrange a suitable program for the dedication, has met with the board of directors and discussed the plane at length.

It is hoped to make such a race an annual event, similar, insofar as may be, to the Phoenix-Los Angeles auto races which were headline events in the West in the earlier years of the century.

Bids on the improvements by which Phoenix hopes to put her airport into the fully approved classification will be called for shortly, and it is believed that all will be competed by February 1.

W.A.E. Gets Sikorsky S-38

LOS ANGELES, CALIF.—The Western Air Express, Inc., Los Angeles, has taken delivery upon a twin Wasp engined Sikorsky Amphibian and has already placed it in service between Vail Field, Los Angeles, and Avalon Harbor, Catalina Island.

Plan Flight to Promote South American Trade

BIRMINGHAM, ALA.—Bettering of trade relations with South and Central American countries is the purpose of a non-stop flight arranged from North America to the northern coast of South America in a tri-engined monoplane, which upon completing the non-stop flight will be flown in a tour of the principal Latin American countries. The itinerary includes 34 trade centers.

The South American Trade Extension Flight, as the organization is known, will show an industrial moving picture in each of the principal trade centers, which will describe the American cities participating in the flight and a group of representative industries which are making a bid for the Spanish-American trade. In addition to this, it is stated, a booklet, printed in the languages of the countries visited will tell of American cities, opportunities and manufacturing.

An advisory board is being selected from the leaders in the principal cities of the United States. The initial members of the board are, Hugh Morrow, president of the Sloss-Sheffield Steel and Iron Co.; Gen. William L. Seibert, chairman of the Alabama State Docks Commission and the Boulder Dam Commission; Col. Marcel Garsaud, general manager of the port of New Orleans; San C. King. vice president of the Bank of Ensley; Lester F. Alexander, president of the Lester F. Alexander & Co.; Victor H. Hanson, publisher of the *Birmingham News* and *Age-Herald;* and Henry Upson Sims, widely known Birmingham attorney and member of the executive committee of the American Bar Association.

Fokker to Offer New Models

HASBROUCK HEIGHTS, N. J.—Plans for the production of three new Fokker models are announced here by Anthony H. G. Fokker. These will be "the largest transport plane ever built in the United States," a monoplane amphibian flying boat, and a cabin monoplane with a capacity of two to four persons. The firm now offers five models: the Standard Universal, the Super-Universal, the F-VII single engine, the F-VII tri-engine, and the F-10.

Builds Testing Equipment

HOLYOKE, MASS.—The Westinghouse Electric Co., it is reported, has just designed and built the largest electrical airplane propeller testing equipment in the world. The apparatus is to be installed at the Army experimental station, Wright Field, Dayton, O.

Martin Buys Mason Company

MASON CITY, IA.—Ross Martin, of Lincoln, Neb., has purchased the Mason City Airways Co.

Aero Factory Permits Lead

SACREMENTO, CALIF. — Airplane manufacturing permits led all other classes of permits to finance factories in California during the first nine months of 1928, according to a recent report of State Corporation Commissioner Friedlander. A total of 13 airplane factories received permission, during this period, to finance their respective projects.

Command-Aire Closes Contract with Phylax

LITTLE ROCK, ARK.—Command-Aire, Inc., formerly the Arkansas Aircraft Corp., has closed a contract with the Phylax Company of Berlin whereby it becomes exclusive North American distributor of the latter concern's automatic airplane fire extinguisher, according to a recent announcement by R. B. Snowden, Jr., president and general manager of the Little Rock firm.

The new apparatus consists of a central chemical tank with pipes leading to seven vulnerable points about the plane. At the end of each is a nozzle which automatically releases a high pressure spray the moment fire occurs, extinguishing the flames.

The device is already widely used on commercial and government planes in Europe and has proven its efficiency in actual fire emergencies in the air as well as under test conditions, it is said. The cost is said to be less than one per cent. of the list price of the average small commercial plane.

The initial American shipment left Germany early in October and Command-Aire, Inc., is now accepting orders for immediate delivery.

Coast Firm to Give Lectures

LOS ANGELES, CALIF. — The American Aircraft Corporation, Los Angeles, reports the opening of a series of winter aeronautical lectures under the direction of Lieut. B. M. Spencer, former Department of Commerce inspector. Lieut. Allen Barrie, formerly flight instructor at the Griffith Park Airport, has also been added to the staff of instructors.

Akerman Gets Mohawk Post

MINNEAPOLIS, MINN.—John D. Akerman will begin duties here as chief engineer of the Mohawk Aircraft Corp. on November 1, it is announced. Mr. Akerman is leaving his position as chief engineer of the Hamilton Metalplane Co., Milwaukee, to become associated with the Minnesota concern.

American Eagle Plans Expansion

Increased Demand for Airplanes Necessitated Refinancing

KANSAS CITY, MO.—A $1,000,000 refinancing program has been announced by the officers of the American Eagle Aircraft Corp. here, together with an expansion program that includes the erection of a new factory and an output of 1,200 airplanes a year. E. E. Porterfield, Jr., is president of the company. The refinancing is being handled through a New York financial house. It was made necessary, Mr. Porterfield said, because of the increasing demand for American Eagle planes.

The new factory will have a total floor space of more than 60,000 sq. ft. It will be located on the southwest corner of the Fairfax Airport on the Kansas side, and will be ready for use by December 15. Three buildings will be included in the new factory; a two-story office building, the main factory 100x35 ft., and a paint shop. The factory will be fireproof throughout and of the daylight type construction.

To Build Metal Plane

In the new American Eagle factory two types of planes will be built. One will be the present commercial biplane and the other an all-metal three-passenger monoplane. Jack E. Foster, chief engineer of the company, has just returned from the Massachusetts Institute of Technology, where a model of the plane was tested in a wind tunnel. Performance of the model indicates the new monoplane will prove a contribution to flying. Construction of the new plane is now under way in the company's factory.

St. Tammany Gets Fokker

ATLANTA, GA.—St. Tammany Gulf Coast Airways, Inc., operators of the Atlanta-New Orleans line has received the first of several Fokker Super-Universals to be used on the extension of the line from New Orleans to Laredo, Tex.

Gets Air Associates Post

NEW YORK, N. Y.—Air Associates, Inc., of this city, announces the appointment of Donald Chisholm to take charge of the Aviation Consolidated Ticket Office. Mr. Chisholm was formerly with Sanderson & Son, Inc.

Brearly Ends U. S. Trip

NEW YORK, N. Y.—Maj. Norman Brearly, managing director of West Australian Airways, Ltd., has left for England following a visit to this country.

Reviews

The Book Department, Aviation, 250 West 57th St., New York City, can supply all books mentioned except government publications. N.A.C.A. publications may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

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Reports and Memoranda of the National Institute for Aeronautical Research, Amsterdam, Holland, Volume IV (Verslagen en Verhandelingen van den Ryks-Studiendienst voor de Luchtvaart, Amsterdam, Deel IV). In Dutch with each report preceded by an extensive summary in English:

Report V 175. The Influence of the Ribs on the Strength of Main Plane Spars. The ribs joining both main spars of an airplane wing bring about a reparation of the load by which the shearing force and bending moments on the spars may be greatly affected. The report gives theoretical calculations of the influence of the ribs. A number of cases are calculated by the theoretical method developed.

Report A 153. The Resistance of Airplane Wheels. Experiments were made in order to investigate how far the resistance of wheels could be diminished by various modifications such as streamline fairing and covering up the re-entering angle made by the rim and some holes. It is shown that by smoothing out the sides and adding fairing the resistance is appreciably decreased.

Report M 219. Mechanical Properties of Some Materials that are Used for the Construction of Airplanes. Steels, woods, light aluminum alloys, and fabrics for covering are discussed and their strengths tabulated.

Report A 32. Experiments on the Ailerons of a Thick Tapered Wing.

Report A 98. Air Resistance of Two Airplane Radiators.

Report A 105. Further Experiments on the Influence of Rotating Cylinder in a Wing Section.

Report A 129. Experiments on the Velocity Distribution in the Boundary Layer of an Airfoil with Rotary Cylinder.

Report A 130. Discussion of the Tests in the Boundary Layer of the Airfoil with Rotating Cylinder.

* * *

The War in the Air, Volume II, which is a continuation of the story of the Royal Air Force and the part it played in the World War, has just been placed on the market. The author of this volume of the history is H. A. Jones, who was selected to carry on the work of the late Sir Walter Raleigh, the author of the first volume.

This second volume describes the operations of the British air forces through 1916. In it, is told the air story of the western front from the winter of 1914-15 to the end of the battles of the Somme, the Dardanelles campaign, the bombing operations from Luxeuil, the naval air operations from Dunkirk and the naval activities in the British home waters. The price is $7.50.

Flys Waco in Outside Loop

TROY, O.—According to reports at the Advance Aircraft company here, Freddie Lund, test pilot for the firm, recently performed a perfect outside loop in a Sport Waco over the company's test field here. This is said to be the first time such a maneuver has been accomplished in a commercial plane.

Starting his loop at an altitude of 2,600 ft., Lund dived 1,800 ft. for speed, then rolled over on his back at the bottom of the loop. Shoving his stick all the way forward, he accomplished the outside loop, then rolled out of it into horizontal flight. Lund also performed a triple vertical roll.

Motion Pictures to be Conference Feature

WASHINGTON, D. C.—Motion picture films brought over by foreign delegates and others obtained from the American Government archives and the libraries of leading newsreel organizations will be shown at the Washington Auditorium as part of the program devoted to aeronautical history in the International air conference, scheduled here December 12-14. The public will be invited to the showing of the motion pictures.

Present at the conference and participating in this program will be many of the men who actually took part in pioneer flights. Arrangements for this feature of the conference, which is primarily to be devoted to an interchange of views on the use of aircraft in commerce and trade, are in the hands of a committee headed by Starr Truscott, aeronautical engineer, National Advisory Committee for Aeronautics.

University of Kansas Offers Aero Course

LAWRENCE, KAN.—The University of Kansas is now offering an advanced course in aeronautical engineering to senior students in the Department of Mechanical Engineering. Classes in aerodynamics and aircraft design are being given. Other courses will be added later. At present there are 14 senior engineers and two graduate students enrolled. Prof. Earl D. Hay, who has had a number of years experience in teaching aeronautics, is in charge.

Name Radio Station Director

WICHITA, KAN.—F. R. Robinson has been selected by the Department of Commerce as operator in charge of the new radio station at the municipal airport here.

Trade Tips

It is reported that—

An airport is soon to be established on the Louisville Pike west of Bridgetown, O., suburb of Cincinnati, with hangars, repair and supply equipment, etc. Purchase negotiations are being carried on by the Western Hills Realty Co., Cincinnati.

—Feeling in Spain is very kindly toward American aircraft products, and the suggestion is made by the Aeronautical Chamber of Commerce of America that manufacturers attempt development in this field, especially with reference to military craft.

—The San Francisco Aircraft Specialties Corp., in which J. R. Gilbert, 408 Warren Road, San Mateo, Calif., is interested, is soon to prepare plans for an airplane and accessory factory at San Mateo.

—Plans for the construction of a $20,000 building for hangar, repair shop, service shop, and office are announced by the Winstead Brothers, who operate at the Wichita Municipal Airport.

—The authorities of Croydon Airport, London, are desirous of securing literature descriptive of equipment for airport lighting. Address Officer in Charge, London Airport, Croydon, England.

—Bids are being received for the construction of a $10,000 hangar at the Illinois-Iowa Airport Corp. Field, Davenport, Ia. N. H. Tunnicliff is engineer for the corporation.

—Laredo, Texas, is to vote a bond proposition for the establishment of an airport on a 384 acre tract. The fund would include construction of hangars, building of runways, etc.

—An airplane landing field and polo ground is planned by the Wyndhurst Country Club, Lenox, Mass. There are 800 acres in the club property.

—The city council of Santa Monica, Calif., has approved plans for the erection of two hangars, 100 x 135, at Clover Field Municipal Airport.

—Airports are planned by Picayune, Miss.; Somerset, Pa.; Hot Springs, S. D.; Beaver Dam, Wis.; Huntington, Ind.; and Storm Lake, Ia.

—George Loomis of Whittier, Calif., plans the construction of a five room frame hangar, 68 x 70, two frame offices, and other buildings.

—Plans are being made for the erection of a hangar at Gilette, Wyo., according to H. J. Jones, N.A.A. member there.

—Blackfoot, Ida., has named a chamber of commerce aviation committee to locate a suitable airport.

AIRPORTS AND AIRLINES

Start to Develop Cincinnati Field

Plans Indicate That Completed Airport Will be Among Largest

CINCINNATI, O.—This city's plan for the development of its municipal airport indicates that the completed field will be one of the largest in the country. Considerable study of other airports by city officials and architects preceded final decision.

The happy situation of three square miles of flat bottom land, 20 min. from the post office is the first great advantage the city enjoys. This land lies at the confluence of the Little Miami and the Ohio rivers. Lunken Airport, as it now exists is about one-fifth the size of the entire city-owned section.

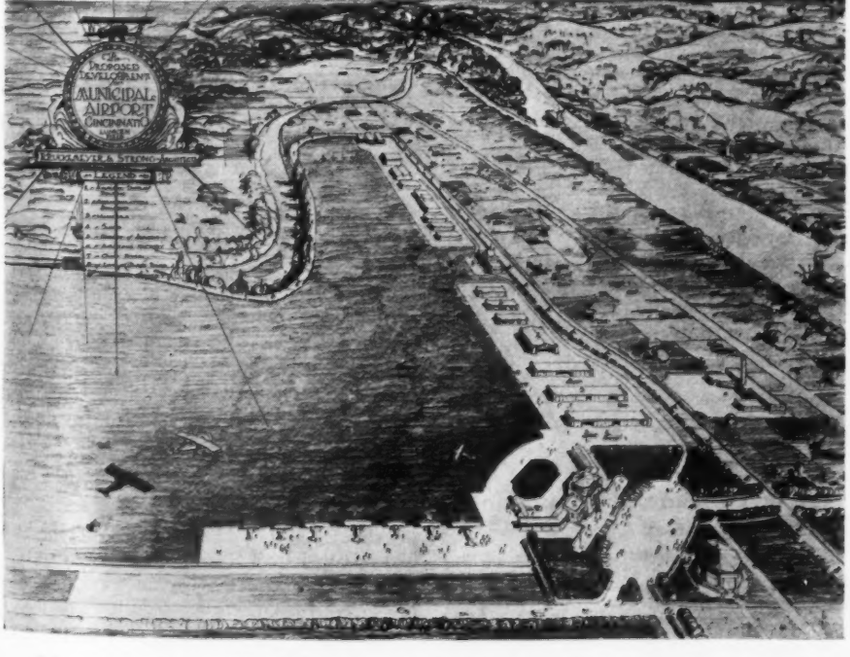
Construction is being started on the dike along the Little Miami. This dike will prevent flooding up to a 65-ft. stage of the Ohio River.

The deed of gift from the Lunken Airport Co. to the city required that $60,000 be spent in improvement within 60 days. The city has voted a $500,000 bond issue for development of the port.

The accompanying picture shows the proposed complete development of the field. An operations office with glass sides surmounts the administration building, a public address system will be installed for the use of the municipal officer in charge of the field. The Embry Riddle Co., offices, a restaurant, waiting room, rest room, etc., will be housed in this building. Hangars and shops will extend along the western edge of the field. All of these buildings will be surrounded by a hard surfaced apron.

Loading stations will be spaced along a 300-ft. concrete apron, and it is believed that the dust and grime of today's average airport will be eliminated. In this respect, Lunken Airport is fortunate in having a heavy carpet of blue grass sod.

Robert N. Olin, director of service of Cincinnati, is in direct charge of preparation of the airport and will be the city's official representative when the field dedication ceremonies are held.



A layout drawing of the proposed Cincinnati Airport, showing location of hangars, administration, and school buildings.

Uniforms for Field Personnel

LOS ANGELES, CALIF.—Believing that the appearance of field personnel has influence upon prospective patrons, Jack Frye, president of the Aero Corporation of California, has instructed all members of his field and flying organization to wear a uniform, consisting of black shirt, black puttees, and whipcord riding breeches, while on duty at the airport.

Cotton Dusters' Season Closes

Texas Company Ends Fourth and Most Profitable Year

HOUSTON, TEX.—Pilots Lewis Moore and Victor Martin flying J-1 Standard Dusters, powered with aircooled Radial Rhone engines, have returned to Houston, having just closed the cotten crop dusting season for the year. These planes are from the fleet of eight cotton dusting airplanes operated by Texas Aero Dusters, a Houston enterprise, owned by Capt. J. C. Tips, Jr., and T. L. Smith, Jr.

During the season just closed, which started in June, these pilots dusted 24,650 acres of cotton in boll weevil control, using upwards of 450 tons of calcium arsenate. Much of the acreage treated had three and four applications of poison of six pounds per acre.

Dusting by airplane is done by flying a specially designed and constructed plane, equipped with a hopper tank, holding 600 lb. of the poison, very low over the fields, usually rolling the wheels on the tall stalks of cotton and discharging the poison through a specially designed orifice in the bottom of the tank and through a venturi-like chute into the propeller slipstream.

In speaking the season just closed, Captain Tips stated that the operations this year were much more successful and profitable than in any of the three previous years his firm has been doing this class of work.

Dallas Reports Plans For New Air Lines

DALLAS, TEX.—Announcement has been made of a new air line between Dallas and Wichita Falls, Tex., operations to begin by December 1. Headquarters of the operating company is in Wichita Falls. Fulcher Armstrong, Wichita Falls, is president of the new company.

The American Air Transport Co., in Dallas, headed by Carey E. Prebenson, has announced inaugurations of service over a line routed through West Texas cities within "30 days." This line's tentative routing includes Wichita Falls.

Install Cedar Rapids Lights

CEDAR RAPIDS, IA.—The lighting system for the local flying field, ordered some time ago by the aviation committee of the chamber of commerce, has been delivered and is now being installed.

Open Hancock's California Field

Ceremonies Include Races and Inauguration of New Service

SANTA MARIA, CALIF.—Dedication of the airport here, owned by Capt. G. Allen Hancock, backer of the Southern Cross flight, was held October 21 with more than 50 planes attending. The ceremonies also included the inauguration of Captain Hancock's Santa Maria Airlines. Races and various other contests, involving $2,700 prize money, featured the day.

Visitors included Al Wilson, Art Goebel, Earl Ovington, Wallace Beery, Alan Loughead, Lieut. Paul Richter, Emory Bronte, and many others prominent in aeronautics. Color was added by Army and Navy fliers from Crissy Field, San Francisco March Field, Riverside and Rockwell Field, San Diego.

Richter Wins Cabin Race

Some 25,000 spectators viewed the races, which started at 1 P. M. In the 25 mi. race of closed cabin planes, Lieut. Paul E. Richter, Jr., flying a Wasp powered Fokker Super-Universal, entered by the Aero Corporation of California, took first. Herbert J. Fahy, in a Whirlwind Ryan Brougham, entered by Mutual Aircraft of Los Angeles, took second; August Clancy, in a Velie Monocoupe, entered by John M. Burnley, Pomona Airlines, was third; and Joe Clancy, also flying a Velie Monocoupe, entered by Burnley, took fourth.

In the 25 mi. 800 cu. in. free-for-all event, the order of the finish was: H. C. Lippiatt, in his Whirlwind Travel Air; Slim Mulholland, Wallace Beery's Whirlwind Travel Air; Lieut. Paul Richter, Jr., Whirlwind Eaglerock, entered by A. E. Cameron Motor Rim and Wheel Service, Los Angeles; and Hal Rouse, Santa Maria Airlines' Whirlwind Stearman. The winner's time for this three lap event was 122 m.p.h.

Dead Stick Contest Close

The dead stick landing contest proved of great interest. Fritz Secor, flying John M. Burnley's Pomona Airlines entry, an OX Eaglerock, took first, attaining a position only 1.4 ft. from the line, while Leo Nomis, was a close second when he was measured at 1.8 ft. from the mark. Nomis flew a Travel Air from Clover Field. Eddie Angel, in an American Eagle, entered by Associated Aircraft, was third.

Al Wilson entertained the crowd with a flight in his old pusher type craft, while the Navy Sea Hawks went through their evolutions. A prize, awarded for the best looking plane, went to Alvin Knechtel, who brought a green and orange Waco. OX and light plane races were also held.

Earl Covington was starter and referee, while the judges were Leslie Miller, Miller Airplane Products of Los Angeles; A. W. Felts, Roscoe McCabe, Jesse Chambers, M. R. Bellman, Paul Bradley and Ralph Dillon.

Santa Maria lies midway between Los Angeles and San Francisco on the coast route. The airport, four blocks from town, is 3,000 ft. by 5,000 ft. The entire field is rolled, oiled, lighted, and unobstructed, with five large hangars a machine shop, and an administration building.

The first four in the 25 mi. OX race were Leo Nomis, Travel Air; Fritz Secor, Eaglerock; G. R. Vaughan, Waco; and Dick Renaldi, Waco. In the light plane race over the same distance, August Clancy was first, flying a Velie Monocoupe, with Joe Clancy, Velie Monocoupe, second; and N. G. Mead, Le Blond Golden Eagle, third.

40 Plane Hangar For Kansas City

KANSAS CITY, MO.—Construction work has been started on the largest airplane hangar in the Kansas City area. The building, being erected on an airport development of the Woods Brothers Construction Co. on the Kansas City side, will accommodate 40 aircraft and also will provide class rooms for four flying schools.

The Woods Brothers concern also has purchased the hangar and club house of the Sweeney Flying School at Fairfax Airport, it is announced, and these buildings will become units in the development.

Vance to Inaugurate New Montana Service

GREAT FALLS, MONT.—The Vance Air Service, Inc., announces that on November 1 the company will inaugurate a daily passenger service between Great Falls and Billings.

A five place Stinson-Detroiter cabin plane will be used to open the service. Mr. Vance has used this plane many times for service between the cities. So many people have petitioned the Vance service for regular flights that the company has decided to begin operations on the above date.

As business increases more cabin planes will be added according to needs. When this new passenger line begins it will place Great Falls as the air center of Montana.

New Oklahoma Texas Line

OKLAHOMA CITY, OKLA.—The Amarillo Airport Corp. has opened a twice-weekly air service between Oklahom City and Amarillo, flying round trips Tuesdays and Fridays. Harold English pilots the Ryan planes used on the route.

Authorize Bond Issue For Evansville Airport

EVANSVILLE, IND.—With the authorization by the Evansville City Council of a $190,000 bond issue to finance the project, this city is assured of a municipal airport, for which local aviation enthusiasts have been working hard to the last few months.

Work will begin on the airport as soon as the bond issue is sold. The B. Russell Shaw Co. of St. Louis will draw up the plans and specifications, on which basis bids will be taken and contracts let. The airport site is a 256 acre tract two miles from the city limits on State Highway 41.

Inasmuch as Evansville is on the Chicago-Atlanta air mail route, to begin service this month, and the municipal airport cannot be completed for some time, local interested citizens have raised $25,000 to put the field in shape to meet Government requirements for an emergency landing field. W. W. Gray, bank president, has donated up to $2,000 for the leveling of the field.

Will Include Toledo in Detroit-Cleveland Line

TOLEDO, O.—This city will be included in the seaplane service between Detroit and Cleveland to be inaugurated next summer by the Detroit & Cleveland Navigation Co., operators of a passenger steamer line. A. A. Schantz is president, with headquarters in Detroit.

Two 25-passenger Dorner Superwal all-metal planes have been ordered from the Metallbauten Co., Friedrichshafen, Germany, Mr. Schantz has announced. They will be equipped with American engines capable of a top speed of 133 m.p.h. Other planes may be added later.

The fare will be $.15 per mile, which will bring the fare betweeen Detroit and Cleveland close to the present train fares, since the rail route has to follow the lake shore and so is nearly twice as great a distance as the direct air line.

Plans Air-Rail Service

NEW YORK, N. Y.—Air-rail passenger service, between the United States and the West Indies, a first step in the extensive Pan American Airways system, will be inaugurated January 10, it is announced. Rail service will be offered to Miami, the terminal point, from whence tri-engined planes will fly to Cuba and the Indies.

Announce Asheville Service

ASHEVILLE, N. C.—T. J. Roberts, president of the Roberts Aircraft Co., announces regular airplane service at the Asheville-Hendersonville Airport Field flights for $3, city flights for $5, and cross-country journeys in the vicinity for $20 are offered.

Capitol Offering New Air Service

Indianapolis-Detroit Line Was Scheduled to Start October 22

INDIANAPOLIS, IND.—A new airline, offering daily freight and passenger service to Detroit, with stops at Ft. Wayne and Toledo, was scheduled to be established by Capitol Airways, Inc., on October 22. Delivery has been made from San Diego on one of five Ryan cabin monoplanes to be used for this service. Routes are also being planned from Indianapolis to Louiseville, Chicago, Cleveland, and Cincinnati.

A steady progress in its airport operation has been made by Capitol Airways, Inc., since its incorporation in April this year. After operating in rented quarters for three months, the company leased 175 acres for five years northwest of the city, built a 10-plane hangar and offices, and opened a flying school and passenger service with an equipment of two Eaglerocks and one Swallow. Added to these will be the five new Ryan Broughams and three new type Eaglerock biplanes. A second 10-plane hangar is being built, and on its completion a third will be erected; floodlights and boundary lights for night land will be installed shortly and available landing space increased to 110 acres.

Capitol Airways, Inc., has state sales rights for the Ryan, and is also dealer in several surrounding counties for the Eaglerock.

Incorporators of the company are, Elmer H. Jose, Mrs. Helen Jose, Edward M. Johnston, L. W. Hottel, Indianoplis; Ray E. Davis, Homer McCray, Kendallville, Ind., and Stanley Chelmainaik of South Bend, Ind. Officers are Mr. Jose, president, Mr. Davis, vice president, Mr. Hottel, treasurer, and Mr. Johnston, secretary and chief pilot. In the flying school, Mr. Johnston is chief instructor, assisted by Fred Lanter.

The capitalization of the company has been increased from $20,000 to $250,000. according to Mr. Jose. It is also stated that plans are being made for the manufacture of aircraft on the field in the spring.

Starts New Taxi Service

NORTHAMPTON, MASS.—An air taxi service has been inaugurated between this city and Williamstown. Williams College students are reported as ready customers with a desire to visit Smith College students by air.

New Lights for Norton Field

COLUMBUS, O.—All six of the new flood lights at Norton Field have been placed in operation. They illuminate an area of 1,200 by 1,200 ft.

Compare Road And Air Line

SAN FRANCISCO, CALIF.—Fly your airplane from San Francisco to New York City, and do 513 mi. of roundabout maneuvering and other gymnastics along the way. Certainly a waste of time, but that is what you do when you drive your automobile over the same route.

It is exactly 3,143 mi. from San Francisco to New York via the Lincoln highway. Over the transcontinental air routes of Boeing Air Transport and National Air Transport, the distance is 2,630 mi.—which means that the shortest highway does 513 mi. of meandering.

November 15 Set for Pontiac Field Opening

PONTIAC, MICH.—This city's new 160-acre airport, for which a $180,000 bond issue was voted last May, is rapidly nearing completion and is now scheduled to be opened November 15. Negotiations, furthermore, are underway to add 80 more acres adjoining the tract.

The field is being equipped with a steel hangar 50 by 50 ft., now nearly finished, and two criss-cross runways are being graded and seeded. A steel fence is being built around the field, and underground wiring has been installed for boundary, obstruction, and flood lights.

The field is on the Ford Airport-Flint Airport route and lies on C. A. M. No. 27 operated by the Thompson Aeronautical Corp.

Circus Receipts Used To Buy Field Lights

MARION, IND.—A rotating beacon light with a 75 mi. visibility, boundary lights, and four flood lights, have been purchased for the J.A.C. municipal airport here from funds received at an air circus staged October 13 and 14. A crowd estimated at 4,000 persons attended. The area of the field has been increased to 75 acres with the recent purchase of 45 acres.

With the purchase of equipment for night flying and the increased size of the field a petition is to be presented to the post office department asking that the field be made a stopping point for mail planes which will cross here when routes from Terre Haute to Toledo and Dayton to Chicago are established.

Norman to Vote on Field Bonds

NORMAN, OKLA.—Norman will vote November 8 on $50,000 worth of bonds to be used in establishing a new municipal airport.

Appropriation Made For New York Field

BROOKLYN, N. Y.—An additional $2,500,000 is to be appropriated for the completion of Floyd Bennett Field, New York City municipal airport at Barren Island, according to an announcement here. The funds are to be raised by tax bonds, it is stated.

Among the features of the new field will be a California privet hedge as a protection against accumulating sand at the windward side of the airport. "The hedge," declares Clarence D. Chamberlin, city airport engineer, "is preferable to the conventional fence and is less hazardous to pilots taking off or landing in this sector of the field.

A permanent grandstand to seat 10,000, a special mail and ticket office, a meteorological station, and complete lighting equipment are planned. Dredging work on the airport, just completed, brings the surface of the field 16 ft. above mean water level.

New York-Miami Line Is Planned by Pitcairn

PHILADELPHIA, PA.—Plans for a New York-Miami passenger air line are announced by Geoffrey S. Childs, vice-president and general manager of Pitcairn Aviation, Inc. Tri-engined planes of an unannounced type are to be operated on the line.

The first link of the line—306 mi.—will be opened between Atlanta and Greensboro, N. C., in the Spring. The Winter months will be spent in arranging equipment and terminal facilities and the assembling of skilled personnel. The link will be rapidly followed by extensions north and south until ultimately the full line will be in operation.

Henderson to Direct L. A. Field

LOS ANGELES, CALIF.—Clifford W. "Cliff" Henderson, managing director of the National Air Races for 1928, has been temporarily appointed as Director of Municipal Airports for the city of Los Angeles. The Civil Service Commission is to give an examination for this post within six months and the permanent appointment will be made from a list of the three highest men in the examination. The salary is $400 per month.

B. & O. Plans Air-Rail Line

BALTIMORE, MD.—Plans for an air-rail service have been announced here, it is reported, by the Baltimore & Ohio Railroad. The flights would be made between Chicago and St. Paul, connecting at the latter city with rail service to the West and at the former with the Baltimore and Ohio company's trains to various eastern points.

FOREIGN ACTIVITIES

Geared Bristol Leads in Meet

Smolik S. 16 With Jupiter Engine Takes First Honors

FILTON, ENGLAND.—In a recent flying meeting of the Petite Entente, a Bristol geared Jupiter powered Smolik S. 16 plane flown by Commander Kalla and Mechanic Tauffer, led with 6,962 points over 5,928 points for its nearest rival in a competition reserved for two place reconnaissance or day bombers adopted by the armies of Yugo-Slavia, Roumania, Czecho-Slovakia, and Poland. The Jupiter engine is manufactured by the Bristol Aeroplane Co., Ltd., of this city.

Two tests were provided. The first was for speed over a circuit of 3,112 km. (1,930 mi.) embracing Prague, Prostejow, Cracow, Warsaw, Lwow, Jassy, Bucharest, Belgrade, Zagreb, Brno, and back to Prague, while the second consisted of a climb to 5,000 m. (16,400 ft.) carrying the same useful load as in the speed trial.

Of the 22 planes which started in the double event, 20 were equipped with water cooled engines and but one with the geared Jupiter air cooled plant. Only 11 planes completed the test.

The winning Smolik S. 16 carried the highest useful load, it is said, namely 1,000 kg. (2,200 lb.) With this load the speed over the circuit was more than 200 km.p.h. (124 m.p.h.). The second plane, with a load of 750 kg. (1,650 lb.) averaged 186 km.p.h. (115.32 m.p.h.)

In the elimination trials for speed, the Smolik attained 232 km.p.h. (143.84 m.p.h.) with a 1,000 kg. load (2,200 lb.).

Dutch Firm Makes Trial Flights to Indies

AMSTERDAM, HOLLAND.—Five trial flights between this city and Batavia, Dutch East Indies, have been undertaken by the Dutch Air Lines (K.L.M.) in preparation for the inauguration of regular air mail service over the route early in 1929. Planes left Amsterdam on September 13, 20 and 27 and October 4 and 11.

The first four flights were completed at Batavia on September 25 and October 2, 9, and 16, respectively, the fifth trip being still underway at this writing. If realized, the new mail service will result in a saving of 15 days between Amsterdam and the Indies. The present time is about 35 days, while with the airplane only about 20 days are required.

Yucatan Linked To Mexico City

MEXICO CITY, MEXICO.—With the cooperation of the Mexican Aviation Co., of which George L. Rihl, an American, is president, air-rail service between this city and Merida, Yucatan, has been inaugurated. Trains now carry passengers to Vera Cruz in 12 hr. and on to Merida by plane in little more than 7 hr., making in one day a journey which formerly required four or five.

Mr. Rihl, Postmaster General Cosme Hinojosa, and the American pilots C. J. Robinson and E. J. Bradley made the initial trip. Robinson and Bradley formerly flew in the Mexico City-Tampico service.

Decree Sets Powers Of French Ministry

PARIS, FRANCE.—By terms of a recent official decree, the newly established French Air Ministry will directly supervise all the personnel, material, equipment, administrative functions, and budgets for all the French civil, colonial, military, and naval operations, it is reported.

The control of all the Governmental activities connected with aernoautics is under Minister of Air Laurent-Eynac.

Line in Peru Reports Capacity Air Traffic

LIMA, PERU.—Maximum capacity air traffic is reported on the Peruvian Air Service operating between San Ramon and Iquitos. Inaugurated in January, 1928, this line was besieged with bookings, and it is now necessary to make reservations several days in advance.

Cost of passage one way is equivalent to $210, with a fare of $400 for the round trip. These rates are slightly more than the charge for transportation over land via the Pichis Trail with launch and steamer accommodations down the river to Iquitos.

The air trip is made in 36 hr., while the other means of travel requires at least three weeks eastward and four weeks westward.

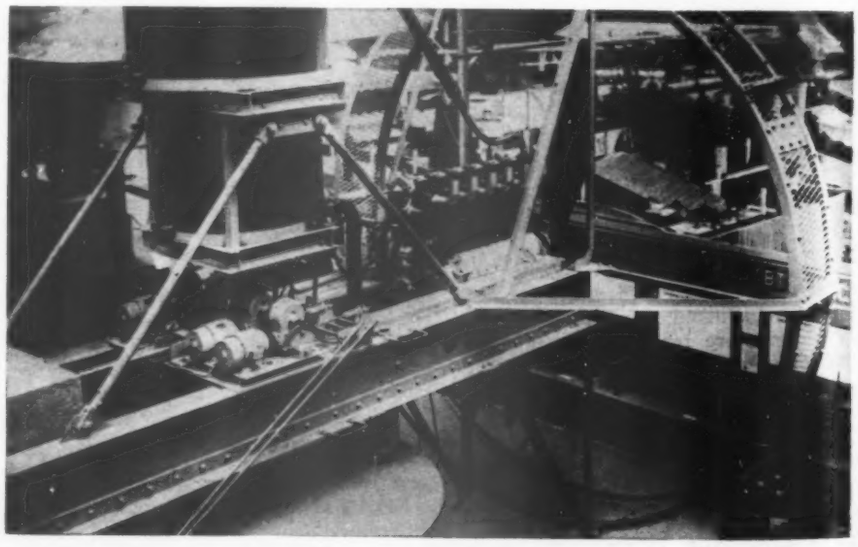
Congo Firm Reports Growth

LOANDA, ANGOLA.—An increase in Belgian Congo air traffic is reported by the Sabena company which operates the services. This line's craft carried 653 passengers during the first five months of 1928 as compared with 682 for the entire year 1927.

Luft Hansa Has 158 Planes

BERLIN, GERMANY. — Deutsche Luft Hansa aircraft now number 158, with 17 differing types and models making up the number. The majority of the craft are Junkers Fokkers, and Dorniers.

Exhibit Test Device at Berlin



Propeller testing apparatus on display at the International Aviation Exposition underway at Berlin, Germany.

THE BUYER'S LOG BOOK

Millburn Carbide Light

A NEW type of carbide light including a generator which uses either lump carbide or carbic cakes is announced by the Alexander Millburn Co.. of Baltimore. Md. While standard Millburn lights operate on both fuels the new type offers certain additional conveniences for those who have occasion to switch from one fuel to another.

Millburn light and fuel container

This addition to the Millburn line is to provide a light or welding generator, with extra gas storage space and which does not restrict the user to any particular kind of carbide. The center of the carbide container is a cylinder which holds the carbic cakes and which is equipped with the proper facilities for taking care of the sludge. The outside of this container is filled with conical pockets for the reception of ordinary carbide.

In designing the new lights, the same features which characterize the standard Milburn lights have been retained, such as the fact that the Millburn light cannot be overcharged; it can be recharged without changing the water; has the automatic burner cleaner which cleans the burner while the light is burning; has low operating cost (slightly more than $.03 per hr. for 8,000 candlepower, using ordinary carbide).

This dual fuel principle is incorporated in single lights of 8,000 and 12,000 candlepower and in the duplex light of 16,000 candlepower. This same principle will be incorporated in lights of other capacities on order. The company stocks a full line of carbide lights of this type.

Boss Flying Suits

PILOTS AND mechanics in many parts of the country are using Boss Flying Suits, made by the Cohen-Goldwater Manufacturing Co., 513-525 East Twelfth Street, Los Angeles, Calif. These suits are made in sizes from 36 to 46 inclusive, of heavy white drill, indigo blue denim or olive drab khaki. They are stocked by dealers in the various aviation centers.

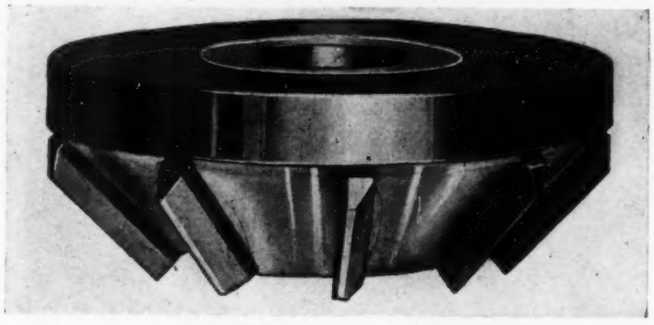
Boss Flying suits have wide double shield fronts which button on the inside and are lockfastened on the outside. They have military collars adjustable for wear over a wool jersey or high necked sweater, and are designed to be worn with comfort over any other clothing. Extra large map and pencil pockets are provided.

Sleeve and leg cuffs are fitted with adjustable snap tabs and two large pouch type leg pockets are also provided. All seams are triple stitched and a full belt is furnished with all suits. The company also manufactures a full line of shop clothing, overalls and similar products of interest to the industry.

Black & Decker Reamers

THE BLACK & Decker Manufacturing Co. of Towson, has recently brought out a complete line of reamers for the valve seats of gasoline engines. These reamers are made of tungsten steel, which is also used in high speed steel twist drills and other cutting tools for severe production work.

Manufactured in sizes from 1¾ in. to 2¼ in., they are a very necessary addition to any shop using the

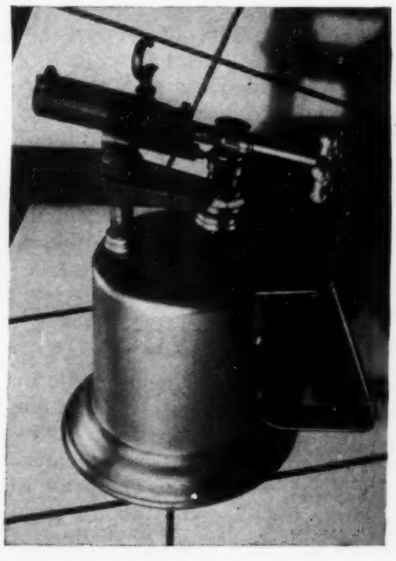


One of the tungsten steel valve seat reamers manufactured by the Black & Decker Company.

Black & Decker method for grinding valves and cleaning carbon. One of the sets contains, in addition to eight various sized reamers, a complete set of expanding pilots, turning wrench, sleeves for reamers or stones, mandrel for grinding reamers or stones, pilot removing pin and universal joint for driving stones.

C. & L. Blow Torch

REALIZING THAT the blow torch is one of the essential tools for the airport machine shop, the Clayton & Lambert Manufacturing Co. of Detroit, Mich., has developed a torch having several patented improvements making it highly adaptable to aviation use. The C. & L. 32 is built for hard usage and rough handling and particular attention has been given to eliminating the usual weak points in blow torch construction.



C. & L. 32 special aircraft type blow torch.

The C. & L. 32 is so designed that a strained or broken handle will not open the gasoline container and cause loss of compression. Another important feature of this torch is the plug at the bottom, which is fitted with a lead washer so that there is no leakage of gasoline at that point.

Fenestra Hangar Doors

HANGARS AT many of the large airports are now equipped with Fenestra doors made by the Detroit Steel Products Co., 2250 East Grand Boulevard, Detroit, Mich., and many airport operators and contractors are taking advantage of the engineering advisory service maintained by the company. Sales and erection organizations, established in all of the larger cities, are available for immediate service.

A typical Fenestra installation showing doors rolled around corner to position along side walls.

Fenestra doors are built entirely of steel and provision has been made to fill two-thirds of the door area with steel sash for glass. Special interlocking joint construction is employed in the sash portion of the door in such a way that 80 per cent. of the steel in each bar is retained. Thus the sash mutins are made to offer great strength with slight bulk and economically sized panes of glass may be used for the admission of daylight.

The doors are made in units and may be so installed as to roll around corners to an out-of-the-way position parallel to the end or side walls of the hangar. Each unit is carried on large ball bearing wheels which roll on floor tracks. No secondary columns are used in the installation.

By using weathering strips at the jams and by overlapping angle guides at the top and by close contact of panel plates with guide rails at the bottom, Fenestra doors are made weathertight. They are fire proof and provide an effective barrier against the spread of fire. These doors are manually operated and, besides being economical, their use permits savings in hangar construction.

Biltmore Seat Covers

SEAT COVERS for airplanes are now being made by the Cincinnati Auto Specialty Co., Cincinnati, O., and one of their first orders was supplied to the International Aircraft Corp., Ancor, O., for one of its five passenger planes. Biltmore seat covers were developed by the company to provide a means of protecting upholstery in planes from the dust and dirt of fields and to present a distinctive appearance.

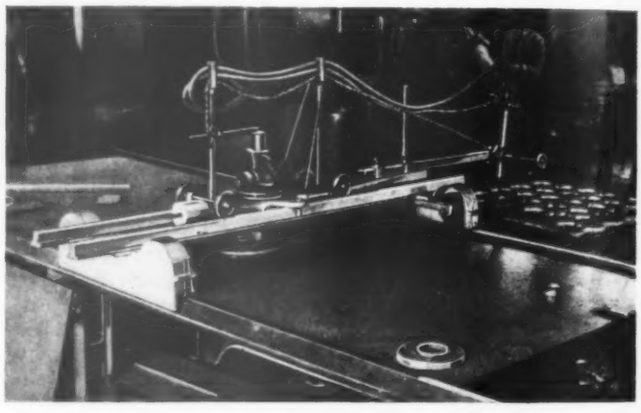
These covers are made of Biltmore Aircraft cover fabrics, tailored to fit, and are intended for long life and hard usage. The material used is durable and of attractive design.

Oxweld Shape Cutter

PRODUCTION COSTS are being cut in many plants by using the automatic oxy-acetylene shape cutting machine introduced recently by the Linde Air Products Co., 30 East 42nd St., New York, N. Y. This machine is designed to cut shapes of any sort from steel plate, sheet, forgings, billets or ingots. The parts are sturdily built without impairing the delicacy of adjustment necessary in a precision instrument of this sort and the design and construction is such that accurate cutting is obtained by the elimination of lost motion.

In this machine the cutting blowpipe is mounted on a carriage which is moved in any direction by means of an electric motor. For routine production it will operate automatically from templets. In cases where only a few parts are to be cut out a hand tracing device can be attached and used to follow the outline of a sketch or blueprint.

The Oxweld shape cutting machine requires but one operator. Little machining is necessary in most cases after cutting because the parts are produced with straight corners and smooth faces. The speed of cutting is very high and ranges from 3 to 20 in. per min., depending on the thickness of the metal. Accurate and smooth cuts can be made in stock up to one foot and more in thickness.



View of oxweld shape cutter showing how circles of various sizes can be cut from templets.

The Cierva Autogiro

(*Continued from page* 1321)

of the blades should only be able to maintain rotation in the wrong direction, that is should make the blades move trailing-edge forward. Actually if the blade system is at rest under the sole influence of such an air flow the tendency would be to cause rotation in this reversed direction and it is necessary to give to the blades an initial impulse to secure rotation in the required sense. Thereafter that rotation is maintained by the air-flow. The reason for this apparent anomaly is a little difficult to put into simple terms, but it may perhaps be explained by analogy with the wings of an ordinary airplane gliding with engine shut off.

The total resultant force on an efficient airfoil at ordinary angles of attack is inclined forward of the normal to the chord of the airfoil, but backwards to the direction of the relative wind. In a horizontal wind this total resultant, therefore, is inclined back from the hori-

zontal, and in horizontal flight there is a drag component calling for a thrust force to balance it.

If, however, the relative wind has an upward component the total resultant force on the wing may be tilted forward until it is vertical, though it is still backward relative to the wind. The machine may then glide horizontally without any thrust being applied to it.

In the Autogiro the backward tilt of the axis about which the blades rotate insures that the mean path of the blades shall be similarly tilted relatively to the wind and therefore that the total resultant force on the blades may be inclined relatively to the axis in a direction tending to accelerate and not retard the rotation at low rates of revolution. As the speed of rotation increases the direction of resultant force will approach more and more nearly to parallelism with the axis, until at some speed this resultant is actually parallel to the axis.

Apart from the friction of the bearings there is then no torque on the system, which will continue indefinitely to rotate at that particular speed. An increase in speed of rotation will at once cause a retarding, and a fall in accelerating torque, so that the rotation is stable.

Owing to the complicated movement of the blades composing the rotating system a steady condition of zero torque for each blade cannot be attained. Each blade alternates between maximum positive and negative torque. In the condition of flight the mean sum of all the torques on all blades becomes zero, and the system is in equilibrium at some speed of revolution which is determined by its particular aerodynamic characteristics.

Speed of Vane System Constant

Apart from a secondary effect caused by the induced inflow into this blade system the speed corresponding to zero mean torque is constant for constant thrust. The thrust must balance the weight of the machine in flight, and therefore the rate of revolution of a given Autogiro vane system in flight is, to within small limits, constant and independent of the precise conditions of that flight.

Mathematical methods of dealing with the aerodynamics of the Autogiro have been developed in England by Messrs. Glauert and Lock* and published by the British Aeronautical Research Committee, and these may be consulted with advantage by those who wish for a detailed analysis of the very complicated phenomena of this type of aircraft. It is, however, only fair to state that these investigations depend on a number of simplifying assumptions which are open to suspicion; the results are not wholly accepted by Señor de la Cierva, and they seem to be a variance with the observed performance.

The most recent type of Autogiro as yet manufactured by the Cierva Autogiro Co., Ltd., known as the Type C.8.Mk.II and is shown in two of the accompanying illustrations. This machine has a standard airplane fuselage identical, except for a few minor modifications, with that used for the well-known Avro Type 504 two seater airplane extensively used for training and other purposes in England. Attached to the top rails of this fuselage above the front cockpit is a pyramid of streamlined steel tubes which support the upper end of the slightly inclined mast which passes down into the fuselage. This lower end of the mast is fitted with a screw and nut gear by which the inclination of the mast may be slightly changed in flight to obtain the best lateral trim. This control is desirable because there is a lateral force on the rotating vanes which changes in magnitude and direction with change of speed.

Running on the mast above the pyramid is a steel block supported on ball bearings of the combined thrust and journal type. This block is machined to form four lugs which carry roller bearings for the main hinges at the blade roots. The axis of these main hinges are horizontal. Each of these lugs is embraced by a forked member which carries a horizontal hinge pin and is provided at the outer end with a vertical phosphor-bronze bushed hole. A second fork carries a pin passing through this vertical hole and a flange to which the root of the blade spars are fastened.

There is thus a double hinge, or universal joint, between the blade and the central hub-block. The object of the second hinge is to prevent transmission to the hub and the mast of shocks caused by the rapid variations of torque which the blades individually suffer. Folding backwards of the blades about this hinge is prevented by

A Cierva Autogiro in flight over the Templehofer airport at Berlin, Germany. The other aircraft shown are two Junkers.

interconnecting each blade to its neighbors on either side by cables attached about half-way out along each main spar. These cables are rigged a little slack and each is loaded centrally with a lead weight.

When the blades are rotating centrifugal force on these weights pulls the cables outwards and keeps them taut. If the torque on each blade were steady the whole system would then rotate uniformly. As the torque on each blade is continuously varying the individual blades will change their relative positions by slight angular movements about the secondary (vertical) hinge and the alternate taking-up and letting-out of slack on the interconnecting cables. The torque variations are thus absorbed in alternate acceleration and deceleration of the blade units and no forces due to this inconstant torque are transmitted to the central hub.

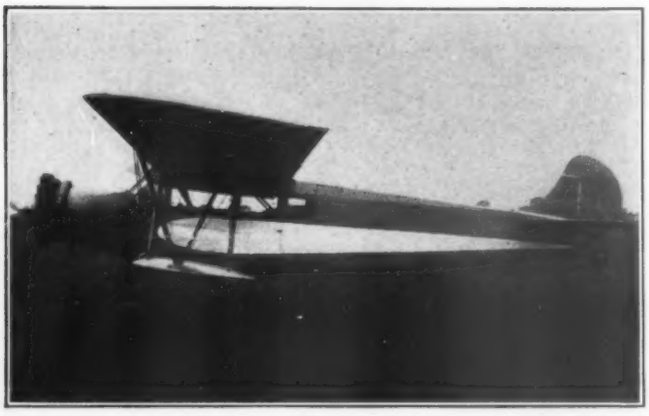
The blades are each built on a single tubular steel spar with spruce ribs. From leading edge to spar the covering is three-ply. At the inner end of each spar is a flange to mate with that on the fork of the secondary hinge. At the outer end a stud on the spar carries adjustable lead weights used to secure dynamic and static balance of the blade system.

Each blade is tapered in plan both inwards to the centre and outwards to the tip. The inner third of the blade is

*R & M No. 1111. A general theory of the Autogiro. By H. Glauert, M. A.

R & M No. 1127. Further development of Autogiro Theory. By C. N. H. Lock, M. A.

The SENIOR AIRSEDAN



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Specifications

Weight Empty	3,000 lbs.
Wing Span	38 ft.
Wing Area	462 sq. ft.
Length	35 ft. 8 in.
Useful Load	3,000 lbs.
Seating Capacity	2 Pilots, 6 Passengers

Performance

High Speed (Sea Level)	135 m.p.h.
Cruising Speed	110 m.p.h.
Landing Speed	45 m.p.h.

Power Plant

Engine	Wasp
Horsepower	425
Fuel Capacity	140 gals.
Oil Capacity	15 gals.

Equipment

Starter; Brakes; Metal Propeller; Compass; Air Speed Indicator; Navigation Lights; Tachometer; Altimeter; Clock; Fire Extinguisher; Fuel, Oil Pressure, and Oil Temperature Gauges; Air Corps Throttles; Strainer and Fuel Valve; Exhaust Manifold; Cabin Heaters.

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merely a fairing for the spar as this section is incapable of producing thrust except in return for excessive torque. The working section is set at a pitch angle which increases progressively outwards from 0 deg. to 4 deg. at the tip.

It should be emphasized that the centrifugal loads on the rotating blades are of the order of ten times the lift loads. The main tubular spar is therefore essentially a tension member, and subject only to minor and secondary bending stresses.

To the bottom of the fuselage, below the mast there is attached a small wing braced by struts whose purpose is to carry a set of ailerons. These ailerons serve precisely

A front quarter view of the Cierva Autogiro, type C6D. This is an earlier model than the type C.8.Mk. II, and has no ailerons.

the same purposes as those of the ordinary airplane. The rest of the machine is also similar to the normal airplane. Except that a specially wide track undercarriage is fitted, and that the elevators have been enlarged and fitted with horn balances, the whole is composed of standard Avro Type 504 airplane components. An Armstrong-Siddeley "Lynx" engine of 180 hp. driving a normal propeller provides motive power.

The operation of this type of aircraft differs little from that of the ordinary airplane. Having started the engine it is necessary to give the vanes a start in the right direction. This can be done by hand from either cockpit. If the engine is then opened up and the machine taxied at 20 to 25 m.p.h. for a minute or so, the rotating wings will accelerate to something near their correct flying rate. If the engine is then opened up fully the machine takes off just as does any ordinary airplane after a short run. In the air it is controlled by the normal airplane controls used precisely as they are normally used.

The machine appears to have a high degree of automatic stability, banks correctly and apparently spontaneously on turns, and for all practical purposes cannot be stalled. The qualification "for practical purposes" is introduced only because according to the mathematical deductions of certain British authorities the Autogiro should have a definite maximum lift and therefore a definite minimum speed at which it can be said to be stalled. Actual performance of these machines suggest that this stalling speed, if it exists, is much lower than the computations indicate.

It is certainly possible to make the Autogiro descend in an apparently vertical path in winds not exceeding four or five miles per hour. The machine is in complete control in such a descent, and its vertical velocity is low enough to allow the shock of landing to be absorbed by the undercarriage.

(*Continued on page* 1344)

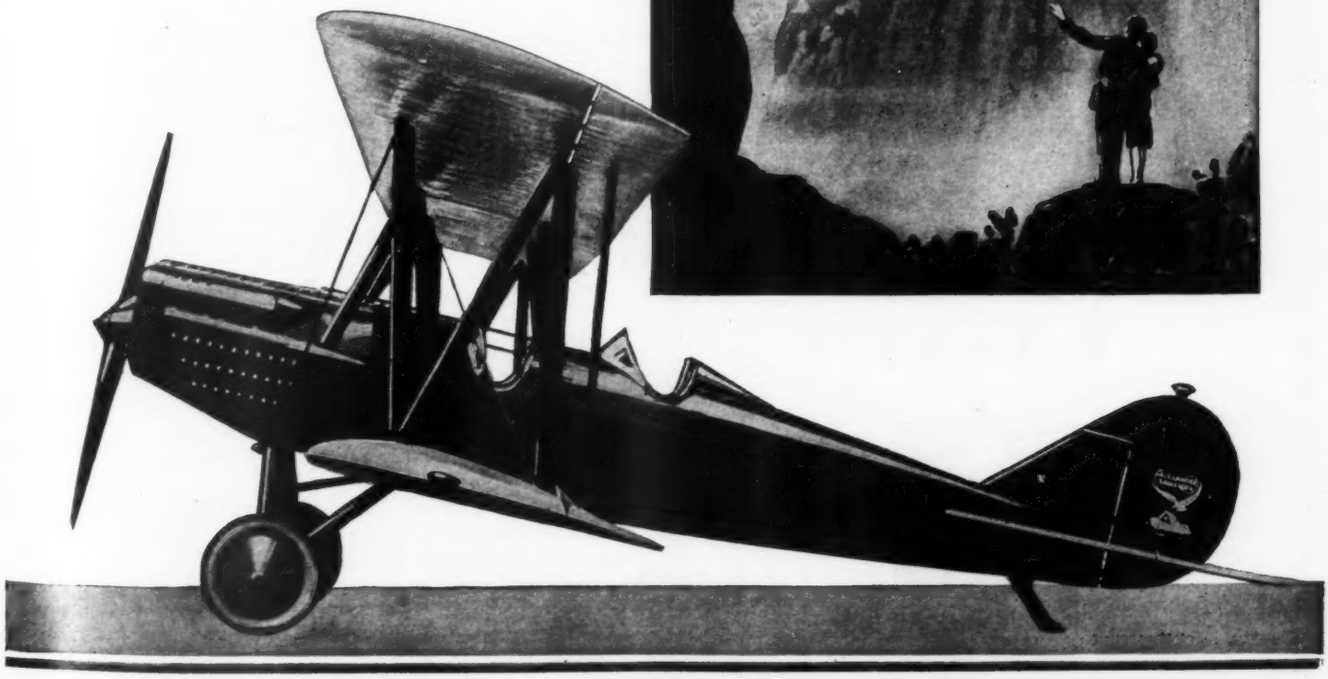
MULTIPLE FEATURES

The response to the throttle—the quick take off—the life—the movement—the control at all speeds—the spirit—the color—the things you have always wished for in an airplane—all combined with safety and good looks * * * THAT is EAGLEROCK! * * * It possesses style—detail—finish—and the ability to stand up, day after day * * * EAGLEROCK is the standard of comparison in its class.

When you buy an EAGLEROCK equipped with a Whirlwind J-4 or J-5, Hisso "A" or "E" or Curtiss OX-5 or OXX-6 you buy a ship built under U. S. Department of Commerce inspection and CERTIFIED. It is priced at $2250 on factory field less power plant and propeller. Certain motors require center section tank and wobble pump as extras.

ALEXANDER AIRCRAFT CO.

Dept. 401, Alexander Industries, Inc.
COLORADO SPRINGS, COLORADO



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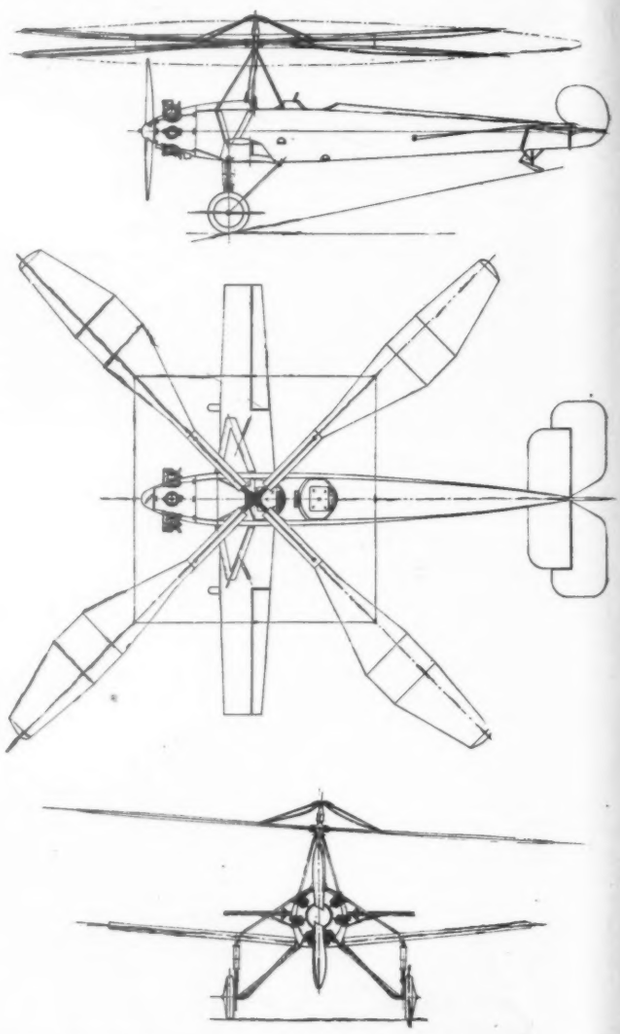
Normal landings are made precisely as with an airplane. The engine is throttled down, the stick eased forward, and the machine will then glide down and can be flattened out at the ground in the usual way. Any intermediate between the normal glide and the nearly vertical descent can be obtained by the use of the elevator. Quite steep dives are equally possible.

The machine is not adapted for stunting and it is a little difficult to conceive of an Autogiro looping, but for all straight-forward flying the machine is somewhat easier to handle than any airplane.

The performance of the Autogiro compares favorably with that of the normal airplane. The type with the 180 hp. Lynx engine has maximum and minimum speeds in



Plan, elevation and profile drawings of the Cierva Autogiro Type C.8. Mk. II. These drawings show clearly the rotating vanes and the construction of the mast which supports the system. The small wing at the bottom of the fuselage, which carries a set of ailerons, is also shown.

horizontal flight of 105 and 25 m.p.h. The minimum forward speed in a glide is not more than 15 m.p.h. and the rate of climb is 500 ft. per min.

Further developments will doubtless lead to even better performance, but at present the Autogiro is definitely a safe, practical flying machine immune from the ordinary dangers of stalling.

The Autogiro Company is at present developing an auxiliary drive which will allow the spinning up of the rotating wings directly by the main engine. This arrangement will make possible a take off at least as good

(*Continued on page* 1350)

MANUFACTURERS' SPECIFICATIONS ON AMERICAN COMMERCIAL

THE TABLE BELOW IS BELIEVED TO BE ACCURATE BUT *AVIATION* D

This table will appear monthly and correct

MANUFACTURER	Designation	Price of Plane at Factory	Type	No. of Seats	Make of Engine	Total Rated HP.	Make of Propeller	Span	Wing Area (Sq. Ft.)	Length Overall	Height Overall	Weight Empty (Lb.) With Water if Water Cooled Engine is Used	Pay Load (Lb.)	Disposable Load (Lb.)	Normal Gross Weight Loaded (Lb.)	L
																High Speed in M.P.H.
Advance Aircraft Co.	Waco 10	$5,535	OBL	3	RS9	125	H,Hs,SS	30'7"	286	23'9"	9'	1330	370	800	2025	107
Advance Aircraft Co.	Waco 10	$2,035*	OBL	3	OX5	90	Hs	30'7"	286	23'6"	9'	1225	360	800	2025	96
Advance Aircraft Co.	Waco 10	$2,585*	OBL	3	E	150	H,Hs,SS	30'7"	286	23'6"	9'3"	1508	600	1092	2600	115
Advance Aircraft Co.	Waco 10	$7,341	OBL	3	J5	200	H,Hs,SS	30'7	286	22'6"	9'3"	1550	600	1050	2600	135
Aero-Craft Mfg. Co.	Aero-Coupe	$5,800	SBL	3	W	110	F	32'	250	24'	8'6'	1100	550	1000	2100	110
Alexander Aircraft Corp.	Eaglerock A-1	.....	OBL	3	J5	200	.....	36'8"	330	24' 11"	9' 11"	.....	.....	.....	2491	130
Alexander Aircraft Corp.	Eaglerock A-2	$2,250*	OBL	3	OX5	90	.....	36' 8"	330	24' 11"	9' 11"	.....	.....	.....	2442	100
Alexander Aircraft Corp.	Eaglerock A-4	.....	OBL	3	E	180	.....	36' 8"	330	24' 11"	9' 11"	.....	.....	.....	2618	121
American Eagle Aircraft Co.	.....	$2,985	OBL	3	OX5	90	H, Hs	30'	300	24' 6"	8' 4"	1227	840	830	2057	101
Atlantic Aircraft Corp.	F-7 & C-2	$44,500	CML	10-12	3-J5	600	H	63' 3"	630	49' 2"	12' 9"	5480	2000	3720	9060	122
Atlantic Aircraft Corp.	Universal	$14,200	CML	5-7	J-5	200	H, Hs	47' 9"	341	33'	8' 9"	2100	1200	1900	4000	118
Atlantic Aircraft Corp.	Super-Univ	$19,340	CML	6-8	P Ww	400	SS	50' 6"	382	36"	8' 11"	2800	1230	2200	5000	140
Atlantic Aircraft Corp.	Fokker F-10	$60,000	CML	14	3-PWw	1200	SS	71'2"	728	50' 8"	12' 5"	7200	2640	4950	11500	148
Arrow Aircraft Corp.	Arrow-Sport	$2,257	OBL	2	LB	60	.....	25' 6"	178	19' 2"	6' 11"	524	....	450	974	105
Bach Aircraft Co.	Air Yacht	$31,800	CML	10-12	2-RSg-pww	650	2 Sty,SS	52'	412	36.1	9' 6"	3300	....	3200	6500	150
Bellanca Aircraft Corp.	CH	$14,500	CML	6	J5	200	Hs	46' 4"	273	24 9	8 6	1850	2229	3284	5134	128
Berliner Aircraft Co.	.....	.....	OML	3	J5	200	SS	34'	206	25'	8'	1400	....	....	2033	136
Bird Wing Commr. Airplane Co.	No. 6	$2,795	OBL	3	OX5	90	Hs	31' 4"	303	23 6"	8' 7	1236	550	1019	2255	90
Boeing Airplane Co.	40-A	$22,500	SBL	3	P Ww	400	H M	44'2"	545	33'4"	11'8"	3313	1579	2687	6000	129
Boeing Airplane Co	40-B	$24,500	SBL	3	P Wh	400	H M	44'2"	545	33'4"	11'8"	3543	1428	2536	6079	132
Boeing Airplane Co.	40-C	$22,500	SBL	5	P Ww	500	H M	44'2"	545	33'4"	11'8"	3522	1445	2553	6075	129
Boeing Airplane Co.	B-1E	$18,500	CBF	6	P Ww	400	H W	39'8"	545	32'6"	12'	3090	750	1460	4550	115
Boeing Airplane Co.	B-1D	$15,000	CBF	4	J5	200	.. ..	39' 8"	466	30' 9"	12'	2442	720	1000	3142	95
Bourdon Aircraft Corp.	Kitty-Hawk	$4,800	OBL	3	RS7	96	W	28'	234	21'11"	8'6"	1102	....	750	1900	110
Breese Aircraft Co.	.....	.....	CML	6	J5	200	SS	41'	260	27'	10'6"	155	..	1000	2550	120
Brown-Mercury Aircraft Corp.	C-3	$9,800	CML	3	3-A6	180	Sty	41'6"	260	25'	.....	1450	600	1500	2950	120
Buhl Aircraft Co.	Airsedan-C5A	$13,500	CBL	5	J5	200	SS	42'	334	28	10'	2072	1000	1628	3700	120
Buhl Aircraft Co.	Airsedan CA-3C	$12,000	CQL	3-4	J5	200	M	36'	240	28'	8'6"	1800	655	1400	3200	139
Buhl Aircraft Co.	Junior Airsedan	$8,000	CQL	3	W	110	M	36'	240	25'	8'6"	1500	520	1000	2500	110
Cessna Aircraft Co.	2-120	$5,750	CML	3	A	120	H Hs	40'6"	224	23'8"	7 4	1250	480	750	2000	125
Cessna Aircraft Co.	4-125	4,075*	CML	4	RS9	125	H. Hs	40'6"	224	23' 8	7 4	1260	760	1030	2280	125
Cessna Aircraft Co.	4-200	$9,800	CML	4	J5	200	H Hs	40'6"	224	23' 8	7 4'	1350	800	1070	2420	150
Command Aire Inc.	Comm'd-Aire	$2,450*	OBL	3	OX5	90	H	31'6"	300	24'6"	8'	1275	375	800	2075	104
Command Aire Inc.	Heinkel H.D. 40	$25,000	CBL	2	PWw	400	M	57'	250	39'	14'	3100	2500	4400	....	140
Crawford M. & A Mfg. Co.	A1	$1,500	OML	2	LR	80	own	30'	150	17' 9"	7'	950	.	450	1400	90
Crown Motor Carriage Co.	B3	.....	OBL	2-3	K-5	100	S	28' 6"	236	21' 3"	8' 5"	850	330	700	1500	110
Curtiss-Robertson A'p'he Mfg. Co.	Robin	$4,000	CML	3	OX5	90	Hs	41'	245	25' 9"	7 10"	1489	328	728	2217	101
Driggs Aircraft Corp.	Dart II	$1,900	OBL	2	A3	35	Hs	28'	140	19' 6"	6'	450	....	370	820	85
G. Elias & Bro. Inc.	M-1	$7,500	OBL	1	L12	400	CR	40'	49.	28'	12	2857	1200	2016	4867	126
G. Elias & Bro. Inc.	Airmobile	$7,500	OBL	3	L12	400	CR	40'	435	28'	11' 3"	2759	420	1290	4049	146
G. Elias & Bro. Inc.	Aircoupe	$3,350	CML	2	A	80	Elias	28 1½"	192	21'	7'2"	870	518	564	1334	96
Fairchild Airplane Mfg. Co.	FC-2W2 land	... ...	CML	5	P Ww	400	SS	50'	332	32'10"	9'4"	2781	....	2719	5500	140
Fairchild Airplane Mfg. Co.	FC-2W2 sea	.....	CMW	5	P Ww	400	SS	50'	332	37'2"	11'7"	3129	....	2371	5500	125
Fairchild Airplane Mfg. Co.	FC-2 land	.....	CML	5	J5	200	CR	44'	290	30' 11"	9'	2150	845	1456	3650	122
Fairchild Airplane Mfg. Co.	FC-2 sea	.....	CMW	5	J5	200	CR	44'	290	32' 5"	11' 5"	2427	833	1573	4000	112
Federal Aircraft Corp.	CM-1	$12,500	CM	5	J4B	200	We	37' 6"	262	29' 3"	9'	2080	630	1395	3475	126
Gates-Day Aircraft Corp.	GD-24	$3,500*	OBL	5	E	180	.....	45'	350	26'	11'	1600	780	1305	2905	115
Gulls Aircraft Corp.	Crusader	.....	CBL	4	RS9	125	Hm	32 9	245	23'	8'1"	....	....	....	2400	110
Hamilton Metalplane Co.	H-19	.....	CML	6	J5	200	H	48'	287	32' 7"	8' 10"	1960	....	2000	3960	120
Hamilton Metalplane Co.	H-45	.....	CML	8	PWw	400	H	54' 5"	390	34'	9'	3100	....	2300	5100	135
Hamilton Metalplane Co.	H-47	.....	CML	8	PWh	500	H	54' 5"	390	34"	9'	3200	....	2450	5650	140
Heath Airplane Co.	Parasol	$695	OML		H	23	own	23'	94	16' 9"	5' 11"	290	....	225	515	70
International Aircraft Corp.	F-17	$2,750*	OBL	3	OX5	90	H	35'	325	25	9' 6"	1300	400	821	2121	100
International Aircraft Corp.	F-17	$2,900*	OBL	4	J5	200	SS	35'	325	25	.....	1350	400	1239	2589	140
International Aircraft Corp.	F-18	$2,250*	OBL	7	J5	200	SS	37'	360	27' 6"	10' 6"	1550	1000	1843	3393	130
Ireland Aircraft, Inc.	Neptune	$14,600	CMA	5	J5	200	CR	40	350	31' 6"	11' 6"	2250	750	1358	3608	95
Irwin Aircraft Co.	M-T-2	$1,165	OBL	1	179	25	own	20'	105	13' 6"	5' 9"	275	100	300	575	90
Kari-Keen Aircraft Inc.	Coupe	.....	CML	2	V	45	.....	30'	150	22'	6'6"	650	480	....	1130	110
Keystone Aircraft Corp.	Pronto	.....	OBL	3	J5	200	.....	39' 11"	365	26' 9"	.....	1975	....	1310	3285	112
Keystone Aircraft Corp.	Pathfinder	.....	CBL	12	3-J5	600	.....	66' 6"	1150	46'	.....	6536	1900	4481	10841	112
Kinner A. & M. Co.	Courier	.....	OML	2	K-	100	SS	35'	216	23'	.....	915	....	550	1465	120
Kreider-Reisner Aircraft, Inc.	Challenger	$2,400*	OBL	3	OX5	90	Hs, H	30' 1"	285	23' 9"	9' 4"	1200	412	811	2000	102
E. M. Laird Airplane Co.	Commercial	.....	OBL	3	J5	200	SS	34'	300	23' 6"	9' 3"	1550	800	..	....	130
Laird Aircraft Corp.	Whippoorwill	.....	CBL	4	J-5	200	.....	36'	351	27	9	1650	....	1000	2650	125
Lincoln Aircraft Co.	Lincoln-Page	.....	OBL	3	OX5	90		32'	300			1200	450	1000	2200	100
Lockheed Aircraft Co.	Vega	.....	CML	5-7	J5	200	SS We	41'	275	27' 5"	8' 6"	1650	1000	1550	3200	135
Lockheed Aircraft Co.	Air Exp.	.....	CML	5-7	P Ww	400	SS	41'	275	27' 5"	8' 6"	1850	1000	1845	3645	167
Loening Aeronautical Engr. Corp.	Cabin Amphibian	$26,700	CBA	5-7	PWw	400	SS	45'	504	34' 8"	13' 2"	3400	1200	2000	5400	120
Mahoney-Ryan Aircraft Corp.	Ryan B1	$12,200	CML	5	J5	200	H W	42'	290	27' 5"	9' 10"	1870	800	1430	3300	126
Metal Aircraft Co.	Flamingo G-1	.....	CML	6-8	PWw	400	SS	48'	354	30'	9'	2800	....	2050	4850	140
Mono Aircraft Inc.	Monocoupe	$2,675	OML	2	V	70	Hs	30' 6"	124	22'	6' 3"	725	....	500	1225	90
Mohawk Aircraft Corp.	Pinto	$2,375	CML	2	A	60	.....	30'	150	20	6' 3	700	....	475	1175	102
National Airways System, Inc.	Air King	$2,395	OBL	3	OX5	90	Hs	34' 1"	310	25' 5	9'	1290	....	800	2090	103
Niles Aircraft Co.	Williams	.....	OML	1	Sa	40	.....	26'	108	18	6'6"	440	....	....	....	85
Pheasant Aircraft Co., Inc.	H-10	$2,375	OBL	3	OX5	90	Hs	32' 6"	283	23' 6"	9'	1297	600	785	2082	100
Pitcairn Aviation, Inc.	Mailwing	$10,000	OBL	1-3	J5	200	SS	33'	252	22' 10"	8' 10"	1612	600	770	2512	136
Pitcairn Aviation Inc.	Super Mai wing	.....	OBL	1-2	J5	200	.....	33'	262	22'10½"	9'3"	1840	....	1160	3000	128
Pitcairn Aviation, Inc.	PA-4	.....	OBL	3	OX5	90	Hs	30'	226	21' 10"	8'7"	1165	....	785	1950	101
Prudden Aircraft Corp.	S-E-1	$22,500	CML	8	PWw	400	SS	57'	427	38'	9' 5"	3000	1280	2065	5065	114
RichmondAirways, Inc.	Sea Hawk	.....	OMF	5	C6	160	.....	46'	317	28'	.....	1700		1000	2700	95
Sikorsky Mfg. Co.	S-37	.....	CBL	18	2P Wh	1000	.....	100'	1049	45' 6"	16' 3"	8000	4060	7000	15000	122
Sikorsky Mfg. Co.	S-38 Amphibion	.....	CQA	10	2P Ww	800	SS, H	71' 8"	720	40'3"	13'10"	6030	2210	4030	10300	125
Simplex Aircraft Corp.	Red Arrow	$3,950	CML	2	K5	100	Sty	33'4"	148	20' 3"	6' 10"	1000	....	600	1600	125
Starling Aircraft Co.	.....	.....	OB	3	OX5	90	..	32'	....	23'4"	9	1237	....	600	1837	104
Stearman Aircraft Co.	C-2-K	$6,740	OBL	3	RS9	125	H, Hs	35'-28'	296	24'	9'	1285	350	865	2150	110
Stearman Aircraft Co.	C-2-B	$8,730	OBL	3	J5	200	H, CR	35'-28'	296	23	9'	1438	400	962	2400	130
Stinson Aircraft Corp.	SB-1	$11,000	CBL	5	J5	200	SS	35' 10"	354	28' 10"	10' 3"	1815	....	1465	3280	118
Stinson Aircraft Corp.	Sm-1B	$12,500	CML	6	J5	200	SS	45' 10"	292	32'	9'	1970	....	1515	3485	128
Stinson Aircraft Corp.	Junior	$6,750	CML	4	W	110	Wd	39' 6"	236	26' 3"	7' 10"	1450	525	1000	2450	105
Spartan Aircraft Co.	C-3	.....	OBL	3	RS9	125	.....	32'		23' 6"	8' 9"	1140	....	800	1940	115
Stout Metal Airplane Co.	4 AT	.....	CML	12	3J5	600	SS	74'	785	49' 10"	12' 8"	6200	2200	3800	10000	114
Swallow Airplane Mfg. Co.	Commercial	.....	OBL	3	OX5	90	.....	32'	300	24'	8' 6"	1470	360	730	2200	100
Tavior Bros. Aircraft Co.	Chummy	$3,800	SML	2	K-5	100	.....	34'	175	22'	7'6"	950	160	550	1500	110
Texas Aero Corp.	Temple	.....	OML		J5	200	.....	39' 4"	225	25' 10"	8' 3"	....	567	....	2250	..
Thaden Metal Aircraft Co.	T-1	.....	CML	7	P Ww	400	.....	53	....	35	11	2900	....	2200	....	..
Thunderbird Aircraft, Inc.	W-14-O	$2,950*	OBL	3	OX5	90	Sty	31'	278	24' 8"	9' 7"	1433	340	815	2248	114
Thunderbird Aircraft, Inc.	W-14-H	.....	OBL	3	E	150	Sty	31'	278	24' 8	9' 7"	1551	500	945	2496	135
Travel Air Mfg. Co.	2000	$2,950	OBL	3	OX5	90	H, Hs	34' 8"	296	24' 2"	8' 9"	1350	350	750	2100	100
Travel Air Mfg. Co.	4000	$9,100	OBL	3	J5	200	H	34' 8"	296	23' 6"	8' 9"	1600	600	1000	2600	130
Travel Air Mfg. Co.	6000	$13,000	CML	5	J5	200	SS, H	48' 7"	282	30' 10½"	18' 8½"	2475	944	1625	4100	128
Travel Air Mfg. Co.	Camines	.....	OBL	3	FC	135	HH, s	34' 8"	296	24'2"	8'9"	1275	400	875	2150	110
Travel Air Mfg. Co.	9000	.....	OBL	3	RS9	125	W	34'8"	296	24'2"	8'9"	1250	360	960	2210	105
Wallace Aircraft Co.	Touroplane	$2,500*	CML	3	A	80	Hs	37'	205	23' 6"	7' 6"	850	320	650	1500	95
Whites Aircraft	Hum. Bird	$2,150	OBL	3	OX5	90	Hs	33' 1"	318	23' 6"	8' 3"	1050	450	850	1900	97
Western Airplane Corp.	King Bird	$2,500	OBL	3	OX5	90	Hs	35'	320	25' 4"	9'	1200	600	800	2000	95
Zenith Aircraft Corp.	Albatross	$35,000	CML	14	3-RS9	375	Sty.	90'	1032	50'	12' 6"	4000	5000	7000	2 000	100

TYPE
A—Amphibian
B—Biplane
C—Closed
F—Flying boat
L—Landplane
M—Monoplane
O—Open
Q—Sesquiplane
S—Semi-closed
W—Seaplane

ENGINE: One engine unless stated in italics.
A—Ansani
C6—Curtiss
E-Wright Hispano-E
FC—Fairchild Camines
H—Henderson
I79—Irwin
J5—Wright Whirlwind
K—Kinner
L—Liberty
LB—Le Blond
LR—LeRhone
OX5—Curtiss
P Wh—Pratt & Whitney Hornet
P Ww—Pratt & Whitney Wasp
RS—Ryan Siemens
SR—Super Rhone
Sa—Szekely
V—Velie
W—Warner
*—Price without engine

PROPELLER:
CR—Curtiss Reed
H.—Hamilton
Hs—Hartzell
M—Metal
Sty—Story
SS—Standard Steel
W—Wood
We—Westinghouse

FUSELAGE
B—Bolted
Cor.—Corrugate
D—Duralumin
F—Fabric cover
Mon—Monocoq
O—Open section
BRAKES:
B—Bendix
Ex—Extra
H—Hydraulic

ERCIAL AIRPLANES AND SEAPLANES AS COMPILED BY *AVIATION*

***TION* DOES NOT ASSUME RESPONSIBILITY FOR THE FIGURES GIVEN**

and corrections and suggestions are invited.

Weight Unloaded (Lbs.)	Performance With Full Load at Sea Level As Supplied by Manufacturers.						Fuel Capacity in Gallons	Normal Range in Miles	Normal Fuel Consumption at Cruising Speed* Gal. Per Hr.	Fuselage Construction	Wing Construction	Are Wings Wired for Lighting?	Type of Control	Brakes	Type of Shock Absorber	Type of Pontoon Provided for	Additional Cost a Seaplane	Dept. of Commerce Type Certificate Number	Performance Figure Guaranteed?	
	High Speed in M.P.H.	Cruising Speed in M.P.H.	Landing Speed in M. P. H.	Climb at Sea Level in F. P.M.	Climb to 10'000 in Minutes	Service Ceiling in Feet														
25	107	93	35	..	..	....	37	..	....	Wl-ST	Wd-F	Yes	SPD	Ex.	O-S	EFH	$1,100	26	....	Advance—Waco Siemens
25	96	85	35	..	..	13,000	48	450	8	Wl-ST	Wd-F	Yes	SPD	Ex	O-S	EFH	....	13	....	Advance—Waco OX—5
00	115	105	40	..	..	15,000	76	..	....	Wl-ST	Wd-F	Yes	SPD	Ex.	O-S	EFH	$1,100	42	....	Advance—Waco Hisso
00	135	118	40	1200	..	18,000	65	..	12	Wl-ST	Wd-F	Yes	SPD	Ex.	O-S	EFH	$1,100	41	....	Advance—Waco W—J—5
00	110	100	38	900	..	12,000	44	460	6.6	Wl-ST	Wd-F	Yes	SD	B	Arl	....	$1,000	Apl.	Yes	Aero-Craft—Coupe
01	130	..	39	1080	..	17,900	..	..	....	Wl-ST	Wd-F	....	SCD	....	RC	E	....	56	....	Alexander—Eaglerock A-1
02	100	87	34	514	..	11,500	46	435	10.3	Wl-ST	Wd-F	....	SCD	....	RC	E	....	7	Yes	Alexander—Eaglerock A-2
08	121	..	40	840	..	14,700	..	..	....	Wl-ST	Wd-F	....	SCD	....	RC	E	....	58	....	Alexander—Eaglerock A-3
37	101	85	30	575	45	12.000	42	425	7.5	Wl-ST	Wd-F	Yes	SPD	Ex	RAR	E	$990	17	Yes	AmericanEagle
00	122	100	55	720	24	12.500	185	580	32	Wl-ST	Wd-P	Yes	DeCD	Yes	RAR	....	....	Apl	....	Atlantic—Fokker F7 & C-2
00	118	98	48	500	40	11,500	78	600	12	Wl-ST	Wd-P	Yes	SCD	Yes	RC	M	$2450	9	....	Atlantic—Fokker Univ.
00	140	118	42	1000	15	18,000	120	700	20	Wl-ST	Wd-P	Yes	SCD	Yes	RAR	M	$3110	Apl	5%	Atlantic—Super Univ.
00	148	125	55	1400	10	18,000	286	580	60	Wl-ST	Wd-P	Yes	DeCD	Yes	RC	....	....	..	....	Atlantic—Fokker F-10
74	105		38	680		15,200	..	..	..	Wl-ST	Wd-F	....	S	....	RC	....	....		....	Arrow—Sport
00	150	110	45	1100	12	18,000	170	500	32	Wd-P	Wd-F	Yes	DeCD	S-B	Hy-C	....	....		Yes	Bach—Air Yacht
64	128	110	40	850	..	13,000	92	800	10	Wl-ST	Wd-F	Yes	SCD	Yes	RC	D	....	47	....	Bellanca—CH
33	136	110	44	..	..	....	44	450	10	Wl-ST	Wd-F	....	D	Yes	....	....	....	39	....	Berliner
55	90	80	30	460	80	10,000	35	325	9	Wl-ST	Wd-F	Yes	SC PD	Ex.	RC	E	$990	Apl	Yes	Bird Wing—No. 6
00	129	..	57	600	25.3	12,000	140	..	20	Wl-ST	Wd-F	Yes	S	S	O	....	....	2	....	Boeing—*40A*
79	132	..	57	800	16.5	15,100	140	..	25	Wl-ST	Wd-F	Yes	S	S	O	....	....	27	....	Boeing—40-B
75	129	..	57	600	25.3	12,000	140	..	20	Wl-ST	Wd-F	Yes	S	S	O	....	....	54	....	Boeing—40-C
50	115	..	56	1000	18.5	12,000	80	..	20	Wd	Wd-F	Yes	Da	....	....	....	....	..	....	Boeing—B-1E
52	95	..	52	..	..	12,000	40	..	....	Wd	Wd-F	Yes	DaD	....	....	....	....	23	....	Boeing—B-1D
00	110	90	38	..		12,000	38	..	6.5	Wl-ST	Wd-F	...	SPD	....	RD	....	....	Apl	....	Bourdon Kitty Hawk
50	120	115	43	900	..	15,500	80	550	9.5	Wl-ST	Wd-F	....	....	....	RC	....	....	..	....	Breese
00	120	100	40	600	35	14,000	78	650	12	Wl-ST	Wd-F	Yes	SC	....	Grs.	No	....	Apl	....	Brown-Mercury—C-3
00	120	95	50	700	45	13,500	70	..	15	Wl-ST	Wd-F	Yes	SC	Yes	OS	Met	$2,500	33	....	Buhl Airsedan
00	139	115	45	900	15	14,000	90	700	14	Wl-ST	Wd-F	Yes	SP	Yes	OS	Met	$3,000	46	5%	Buhl Special Airsedan
00	110	90	40	600	25	11,000	..	600	7	Wl-ST	Wd-F	Yes	SP	Yes	OS	Met	$2,000	Apl	5%	Buhl Junior Airsedan
00	125	110	45-50	1000	..	....	42	400	10	Wl-ST	Wd-F	Yes	SPD	Ex.	RAR	....	....	Apl	5%	Cessna Aircraft Co.
36	125	115	45	1000	..	....	42	400	10	Wl-ST	Wd-F	Yes	SPD	Ex.	RAR	....	....	Apl	5%	Cessna Aircraft Co.
20	150	125	45-50	1400	..	....	42	400	12	Wl-ST	Wd-PF	Yes	SPD	Ex.	RAR	..	..	Apl	5%	Cessna Aircraft Co.
75	104	85	36	550	..	10,000	..	400	....	Wl-ST	Wd-PF	Yes	S	No	RC	E	$1,100	53	....	Command-Aire
	140	..	54	..	..	18,000	..	600	....	Wl-ST	Wd-PF	Yes	DaD	Yes	Arl	M	$2,000	..	5% N	Heinkel H.D. 40
00	90	64	47	..	..	18,000	40	500	6	ST-Wd	Wd.F	No	D		RC	....	....	No	5%	Crawford—*A*
00	110	90	35	750	45	14,000	27	400	6	Wd	Wd-F	No	SD	No	Gra	....	....	Apl	Yes	Crown—B3
17	101	85	46	400	..	11,500	50	607	7	Wl-ST	Wd-FD	Yes	S-PC	No	RAR	....	....	40	5%	Curtiss—Robin
20	85	75	46	560	..	15,000	15	375	3	Wl-ST	Wd-FD	Yes	SC	No	RC	None	....	15	5%	Driggs—Dart II
37	126	105	45	1250	19	15,000	100	525	20	Wl-ST D	Wd-F	Yes	C	No	TR	....	....	No	....	G. Elias & Bros.—M
19	146	125	45	1050	10	16,000	100	625	20	Wl-ST	Wd-F	Yes	SC	No	RC	....	....	..	....	Elias—Airmobile
24	96	80	25	590	..	10,000	20	400	4	Wl-ST	Wd-F	Yes	SC	No	Elias	None	....	..	....	Elias—Aircoupe
00	140	110	55	1050	13	17,500	160	900	20	Wl-ST	Wd-F	Yes	S-CP	Yes	Hy	F	....	61	....	Fairchild—FC-2W2 land
00	125	95	58	900	15	17,000	160	850	20	Wl-ST	Wd-F	Yes	S-CP		....	F	....	20	....	Fairchild—FC-2W2 sea
50	122	103	53	580	27	13,100	110	710	15.5	Wl-ST	Wd-F	Yes	S-CP	Yes	Hy	F	....	10	....	Fairchild—FC-2 land
00	112	..	53	1250	36	12,700	110	650	15.5	Wl-ST	Wd-F	Yes	S-CP	....	....	F	....	10	....	Fairchild—FC-2 sea
75	125	105	40	..		....	84	750	10	Wl-ST	Wd	Yes	SC	Yes	Arl	....	....	..	....	Federal Aircraft—CM-1
35	115	95	35	800	..	16,000	56	..	....	DR-F	Wd-F	Yes	SC	No	RD	None	....	..	....	Gates—Day—New Standard
00	110	90	45	600	..	11,500	45	420	....	Wl-ST	Wd-F	Yes	DaD	B	O	....	....	..	....	Gillis—Crusader
50	120	100	50	750		14,000	80	650	12	D-cor.	D-cor.	Yes	SPD	Yes	O	H	$2500	..	5%	Hamilton—H-19
00	135	115	55	1250	13	18,000	140	750	21	D-cor.	D-cor.	Yes	DePD	Yes	Arl	H	$3000	..	5%	Hamilton—H-45
50	140	120	55		11	18,500	140	700	24	D-cor	D-cor	Yes	DePD	Yes	Arl	H	$3000	..	5%	Hamilton—H-47
15	70	65	32	200	..	....	3.3	120	....	R-ST	Wd-F	No	SC	No	RC	....	....	..	....	Heath—Parasol
21	100	87	35	600	..	10,500	40	450	....	Wd		....	S	Ex.	O	....	....	35	5%	International—F-*17*
39	140	120	35	1000	..	16,000	66	700	....	Wd	Wd-F	....	S	Ex.	O	....	....	Apl	5%	International—F-*17*
33	130	110	40	800	..	15,000	106	1000	....	Wd	Wd-F	....	S	Ex.	O	....	....	Apl	5%	International—F-*18*
08	95	85	46	650	35	11,000	65	500	12	ST-D	Wd-F	Yes	DeD	No	OC	....	....	Apl	5%	Ireland—Neptune
75	90	75	28	400	65	12,000	8	300	1.7	Wd	Wd-F	Yes	SC	....	RC	W	$175	..	6%	Irwin—M-T-*2*
30	110	90	38	680	..	13,000	28	..	....	Wl-ST	Wd-F	....	SPeP	....	RC	....	....	..	....	Kari—Keen—Coupe
35	112	..	..	800	..	14,000	60	..	....	Wl-ST	Wd-F	....	....	....	....	....	....	..	....	Keystone—Pronto
11	112	..	57	570	..	....	..	500	....	Wl-ST	Wd-F	....	....	....	....	....	....	..	....	Keystone—Pathfinder
35	120	110	35	900		20,000	..	800	7	Wl-ST	Wd-F	....	....	S	Gr	....	....	..	....	Kinner—Courier
00	102		39	548	..	12,000	..	400	....	Wl-ST	Wd-F	Ex.	SD	No	RC	EH	$1,100	19	5% N	Kreider-Reisner—Challenger
	130	10	40	1350	10	....	80	600	....	DT, S	Wd-F	....	SPA	....	....	....	....	..	....	E. M. Laird—Commercial
50	125	105	40	..	15	....	..	..	....	Wl-ST	Wd-F	Yes	DaD.	Std	RC	....	....	..	....	Laird—Whippoorwill
00	100	..	35	600	..	....	42	500	....	Wl-ST	Wd-F	....	....	....	....	....	....	28	....	Lincoln—Page
00	135	110	50	1000	16	15,900	100	700	10	W-mon.	Wd-P	Yes	SC	H	RHy	E	....	Apl	5%	Lockheed—Vega
15	167	135	55	1460	10	17,250	100	1000	18	W-mon.	Wd-P	Yes	SC	H	RHy	....	....	Apl	5%	Lockheed—Air Express
00	120	..	50	..	..	14,000	140	650	....	Wd-D	Wd-F	Yes	DaC	Ex.	RC	....	....	34	....	Loening—Amphibian
00	126	108	49	1000	..	16,000	83	700	10-11	Wl-ST	Wd-F	....	SC	B	Grs	E	$1,800	25	Yes	B. F. Mahoney—Ryan B/
50	140	120	48	1250	..	....	150	1000	18	Wl-ST,D	D	Yes	DeDC	S	Arl	....	....	..	....	Metal—Flamingo
25	90	75	35	800	..	12,000	..	360	..	Wl-ST	Wd-F	Yes	S	Std	Arl	....	....	..	....	Mohawk—Pinto
75	102	87	35	700	35	....	25	4 0	4	Wl-ST	Wd-F	Yes	SP	....	RC	....	....	22	Yes	Mono Aircraft—Monocoupe
00	103	85	35	600	..	15,000	35	396	8	Wl-ST	Wd-F	No	S	No	RC	....	....	29	....	National Airways—Air King
	85	..	30	925	..	....	..	360	....	Wl-ST	Wd-F	....	SC	Std	....	....	....	Apl	....	Niles—Williams
32	100	90	35	500	25	12,500	38	400	9	Wl-ST	Wd-F	Ex.	SPD	Ex.	RC	EH	$1,000	36	....	Pheasant—H*10*
12	136	105	45	1600	..	11,000	60	600	....	Wl-ST	Wd-F	Yes	S	Yes	Arl	....	$900	18	5%	Pitcairn—PA-5
00	128	110	45	..	..	....	76	..	....	Wl-ST	Wd-F	Yes	S	....	Arl	....	....	..	....	Pitcairn—PA-6
50	101	82	45	..	..	....	35	400	....	Wl-ST	Wd-F		S	....	Grs	....	....		....	Pitcairn—PA-*4*
35	114	93	59	750	..	12,000	110	540	17	D-cor	D-cor.	Yes	DeDC	Yes	P	....	....	..	....	Prudden—S-E-1
00		95	45	..	..	....	42	..	....	Wd-D	Wd-F	....	DeCP	....	....	....	....	..	....	Richmond Airways—Sea Hawk
00	122	112	58	650		15,000	370	790	50	DOR, B	DOR, B	....	De D	Hy	RDO	....	....	Apl	5%	Sikorsky—S37
00	125	110	55	880	15	19,400	200	500	36	Wd-D	DOR, B	Yes	DeD	....	DOS	WD	....	60	5%	Sikorsky—S38 Amphibion
00	125	110	40	1000	17	16,000	..	1250	5.5	Wl-ST	Wd-F	Yes	S	....	....	....	....	..	5%	Simplex—Red Arrow
37	104	95	30	..	15,000	....	40	400	....	Wl-ST	Wd-F	....	SD	....	HyC	....	....	..	....	Starling
50	110	90	38	625	..	12,000	50	500	7	Wl-ST	Wd-F	Yes	PC	St.	RHy	D	....	Apl	5%	Stearman—C-2-K
00	130	110	41	1000	..	18,000	65	620	11.5	Wl-ST	Wd-F	Yes	PC	St.	RHy	D	$1,200	Apl	5%	Stearman—C-2-B
80	118	100	46	600	..	13,500	70	600	11.5	Wl-ST	Wd-F	Yes	DeD	St.	....	M	$2,500	24	5%	Stinson—SB-*1*
85	128	105	55	750	..	14,000	90	700	11 5	Wl-ST	Wd-F	Yes	DeD	St.	Hy	M	$2,500	16	5%	Stinson—SM-*1*
50	105	90	45	..	..	....	45	550	....	Wl-ST	Wd-F	Yes	DS	Yes	Hy	....	....	..	....	Stinson—Junior
10	115	..	37	800	..	....	44	600	....	Wl-ST	Wd-F	....	S	....	RC	....	....	..	....	Spartan—C-3
00	114	100	55	..	..	14,000	235	540	30	D-cor.	D-cor.	Yes	DeD	St	O	....	....	..	....	Stout—Ford—*4AT*
00	100	..	35	600	..	....	36	500		Wl-ST	Wd-F	....	....	....	RC	....	....	21	....	Swallow—Commercial
00	110	100	38	850		....	30	500	6	Wl-ST	Wd-F	Yes	SP	....	RC	....	....	..	Yes	Taylor Bros.—Chummy
50	..	..	..	..	..	....	50	..	....	Wl-ST	Wd-F	....	S	....	....	....	....	..	....	Texas—Temple
	..	..	..	..	..	....	120	..	....	D-cor.	D-cor	....	De	....	Grs.	....	....	..	....	Thaden Metal—T-1
48	114	95	40	800	20	15,000	43	440	10	Wl-ST	Wd-F	Yes	SpeD	Ex	R	EH Ex	$1,100	Apl	5%	Thunderbird W14-O
96	135	110	42	1000	16	16,000	60	440	15	Wl-ST	Wd-F	Yes	SpeD	Ex	R	EH Ex	$2,950	Apl	5%	Thunderbird W-14-H
00	100	..	42	..	..	12,000	42	410	8	Wl-ST	Wd-F	Yes	SPC	No	RC	....	....	30	....	Travel Air—*2000*
00	130	..	45	..	..	20,000	60	..	12	Wl-ST	Wd-F	Yes	SPC	No	RC	....	....	32	....	Travel—*4000*
00	128	107	50	700	..	13,500	78	650	12	Wl-ST	Wd-F	Yes	DeD	Yes	O	....	....	Apl	....	Travel Air—*6000*
50	110	..	37	..	..	....	42	475	....	Wl-ST	Wd-F	Yes	SPC	....	RC	....	....	37	....	Travel Air—Caminez
10	105	..	42	..	..	....	66	650	....	Wl-ST	Wd-F	Yes	SPC	....	RC	....	....	38	....	Travel Air—Siemens
00	95	82	40	670	37	11,000	28	500	5.25	Wl-ST	Wd-F	Yes	SPD	....	Hy	....	....	..	....	Wallace—Touroplane
00	97	90	35	600	..	14,000	40	350	8	Wd WIS	Wd-F	No	S	....	C	E	....	Apl	5%	Whites—Humming Bird
00	95	85	30	600	20	12.000	..	500	8	Wl-ST	Wd-F	No	SC D	No	RC	Own	$1,000	No	5%	Western—King Bird
00	100	85	35	600	..	20,000	300	1000	20	Wl-ST	Wd-F	Yes	C	Yes	Arl	No			Yes	Zenith—Albatross

* Cruising Speed

FUSELAGE AND WING CONSTRUCTION:
-Bolted
r.—Corrugated
—Duralumin
—Fabric cover
on—Monocoque
—Open section
BRAKES:
—Bendix
—Extra
—Hydraulic

P—Plywood cover
R—Riveted
S—Steel
T—Tubing
Wd—Wood
Wl—Welded

L—Lockheed
S—Sausedde
Std—Standard

LIGHTS:
N—Navigation lights

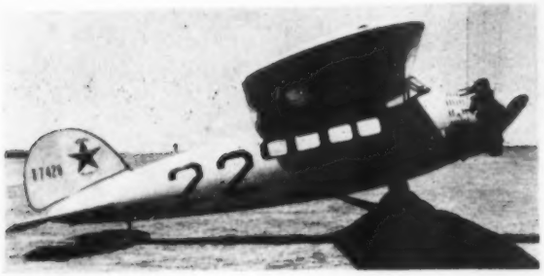
CONTROL:
A—Arens
C—Cables
D—Dual
De—Wheel
P—Push rods
S—Stick
Pl—Pedal

SHOCK ABSORBER.
Arl—Aerol
C—Cord
D—Compression
Grs—Grass
Hy—Hydraulic
O—Oleo
P—Pneumatic
R—Rubber
RAR—Russo Aero Rings
S—Coil Spring
T—Trombone

PONTOONS:
D—Duralumin
E—Edo
F—Fairchild
H—Hamilton
M—All metal
W—Wood

TYPE CERTIFICATE:
Apl—Applied for and is pending

GUARANTEE:
N—New



ERLE P. HALLIBURTON'S *Wasp-Vega. An oil field service plane which won by a margin of over three hours the Class "C" Transcontinental National Air Race Event. Also winner of Closed Course Event No. 6.*

MADDUX AIR LINES, *Los Angeles, operate Whirlwind-Vegas for special charter trips to all parts of the United States. This is in conjunction with their daily schedule service in California and Mexico.*

HARRY J. TUCKER'S *"Yankee Doodle." A stock production Wasp-Vega. Holder of Los Angeles to New York and Los Angeles to Cincinnati non-stop record flights. Art Goebel, Pilot.*

CAPT. GEO. H. WILKINS' *Whirlwind-Vega, which carried him across the top of the world. The Hearst-Wilkins Antarctic Expedition, now under way, is using this same plane and a new Whirlwind-Vega, both equipped with pontoons.*

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—*the choice of veteran pilots*

We point with pride to the distinguished names numbered among those who have purchased Lockheed Aircraft. These names constitute a silent endorsement more powerful than anything we can say. They show an undeniable preference by those who have staked their lives, their business success and their reputations on Lockheed monoplanes. All Lockheed accomplishments and performance records have been made with *stock model planes privately owned.*

Commercial Airplanes wi

Performance figures given below full pay-load and are guaranteed

Wasp-Vega

THE fastest five-place commercial airplane in the world. Performance comparable to that of the fastest single-seater pursuit planes. The choice of those who require maximum high speed without sacrifice of comfort or safety. Holder of Los Angeles to New York non-stop flight record, and many times a winner in National Air Race events. Action of ship in flight shows unusual inherent stability. Permanent alignment, perfectly stream-lined, and head resistance less than one-half that of conventional types. *Delivery twenty-five days after receipt of order.*

Top Speed	170 miles per hour
Cruising speed	135 miles per hour
Climb	1800 feet per minute
Landing speed	55 miles per hour
Pay-load	1000 pounds
Cruising range	750 miles
Fuel consumption	8 miles per gallon

Wasp-A

A SEVEN-PLACE
pound pay-load.
meet the most exacti
passenger and expre
allow all or part of
instantly converted i
model the pilot occup
rear of the cabin. His
to any desired elevati
being mounted on sho
allows him unlimited
The high cruising spe
and its extremely low
senger mile flown m
public and greater pr
formance is approxi
given for the Wasp-V
after receipt of order.

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Air Associates, Incorporated
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THANK YOU *for*

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lots, air line operators and dealers

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Increased production facilities, sound manufacturing methods and adequate financing enable us to announce for the first time that all models of Lockheed Aircraft are now available for *prompt delivery*. Supreme in performance, craftsmanship, comfort and beauty, Lockheed Aircraft meet all requirements for a fast, single-engine cabin transport. Experienced pilots prefer the Lockheed Monoplane for its vision, ease of handling and ability to get in and out of small fields.

with a Fighting Performance!

n below are made from actual flight tests with aranteed to within plus or minus five per cent:

p-Air Express

LACE monoplane with 1,500 ay-load. Designed and built to t exacting requirements for mail, l express service. Folding seats part of six passenger cabin to be verted into cargo space. In this ot occupies an open cockpit in the bin. His seat is adjustable in flight l elevation, and the parasol wing l on short struts above the fuselage nlimited vision in all directions. ing speed of the Wasp-Air Express ely low cost of operation per pas- down mean greater service to the eater profits to the operator. Per- approximately the same as that Wasp-Vega. *Delivery forty days f order.*

Whirlwind-Vega

LUXURIOUSLY appointed cabin monoplane with comfortable accommodations for four passengers, baggage and pilot. The same sturdy plane (with refinements) that carried Captain Wilkins across the top of the world. Vibration and noise eliminated to a remarkable degree by monocoque fuselage construction. A favorite with operators, pilots and passengers. Performance with 220 h.p. Whirlwind engine equals that of many planes using 410 h.p. Wasp for the same pay-load. *Delivery fifteen days after receipt of order.*

Top speed	138 miles per hour
Cruising speed	118 miles per hour
Climb	1000 feet per minute
Landing speed	50 miles per hour
Pay-load	1000 pounds
Cruising range	1000 miles
Fuel consumption	10 miles per gallon

e being allotted to responsible organiza- f the very best territory is still available

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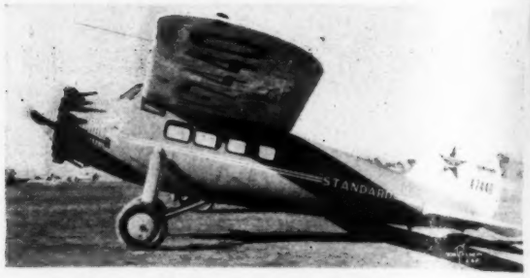
AFT COMPANY
ANGELES U.S.A.

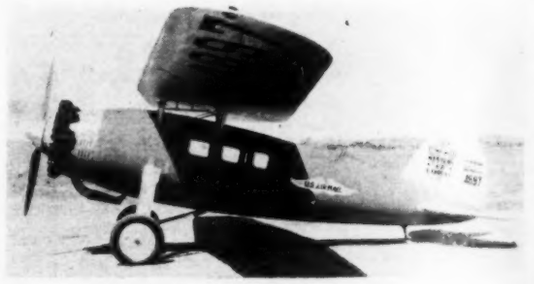
Lockheed Factory, General Offices and Airport are located at Burbank, California, a suburb of Los Angeles
Phones: GLadstone 2171 / Burbank 1681



STANDARD OIL COMPANY OF NEW JERSEY *use Lockheed Wasp-Vega for transportation of officials and inspection of holdings. The familiar Standard Oil color combination is carried out with red fuselage, white wings and blue trim.*

SANTA MARIA AIRLINES, *Santa Maria, California, operate Whirlwind-Vegas. G. Allan Hancock, President of Santa Maria Airlines, is the man who backed the flight of the "Southern Cross" to Australia.*

THE TEXAS COMPANY, *New York, operate "Texaco No. 2," a Whirlwind-Vega, in the sales and advertising of their well-known "Texaco" petroleum products. Frank Hawkes, Chief Pilot.*



WESTERN AIR EXPRESS, *Los Angeles. Veteran air mail pilots and operators have contributed valuable suggestions to the design and construction of the Wasp-Air Express, a seven-place mail and passenger transport with 1,500-pound pay-load.*

WINTER KING
FLYING SUITS
Built for Warmth

Luxurious flying suits made of the finest materials available, tailored by master craftsmen to the tastes and requirements of the flying fraternity, and at remarkably low prices not to be equalled elsewhere.

$29.50

Entirely lined with warm wool felt.

$35.00

Lined with best grade virgin wool.

$39.50

Lined with heavy yellow sheepswool.

$49.50

Lined with the luxurious long nap Peruvian Alpaca wool. A revelation in lightness and warmth.

All sizes from 36 to 46

Read these specifications and compare

Genuine garbardine khaki cloth, patent non-loosening belt buckle; separate fly flap; all points of tear are bar-tacked; legs cut wide—easy to put on and take off; genuine Wombat shearling fur collar 5" high; new style non-creeping Hookless fasteners; two large breast pockets; adjustable wrist straps; two convenient knee pockets and also two hip pockets; Hookless fasteners at leg bottoms.

An exceptional money making proposition for dealers, schools and salesmen.

Write for offer.

AIR TRANSPORT EQUIPMENT, Inc.

Curtis Field, Hangar 20-A
Garden City, N. Y.

Address wires via Hempstead

Phone; Garden City 6666

THANK YOU *for mentioning* AVIATION

(*Continued from page* 1344)

as and perhaps better than that of a similarly powered and equally loaded airplane.

The company is also ready to place on the market a machine known as the Type C17 to compete with the very popular class of two-seater light airplanes now built in England. This machine will be fitted with the four cylinder air cooled 75 to 80 hp. Cirrus Mark II engine, and will carry a crew of two with ample luggage accommodation and three hours' fuel supply. The speed of this machine will be 90 m.p.h., with a minimum speed far lower than that of any airplane of equivalent type, and an approximately equal climb.

This machine except for the rotating wing system will be mainly built up from standard components of the well known Avro Avian light aeroplane. The practical development of the Autogiro has been carried on by the Cierva Autogiro Co. in conjunction with A. V. Roe & Co., Ltd., which accounts for the fact that standard detail construction due to this firm enters so largely into the machines described.

Commander Byrd's Fokker

(*Continued from page* 1325)

With the cabin tank installed, there is ample room for several passengers besides the pilot and mechanic. The tank is fastened in a demountable cradle to permit easy removal when the full freight and passenger capacity is to be used. Ample space is provided for carrying loose five gallon fuel cans. An oil tank, having a capacity of 15 gal., and an expansion space of 20 per cent. of its volume, is placed under the pilot's seat and also can be filled while the plane is in flight. This tank is air cooled having inlet and outlet connections to the air stream. In the rear of the cabin on the right side is an opening 18 x 24 in. in the floor ordinarily closed by a trap door. In front of this opening is mounted a bracket on which the drift indicator can be mounted. Directly above it in the ceiling of the cabin is another opening through which the navigator can put his head and shoulders to obtain a view in all directions for sextant observations.

No Fire Wall in Byrd's Plane

Another outstanding difference between The Virginia and the commercial Super Universal is that the Byrd plane is short coupled, that is the distance between the engine and the wing is eight inches less than in the production plane. This is accomplished by elimination of the fire wall between the control cockpit and engine compartment. This provides greater warmth for pilot and mechanic and ease of access to carburetor, pumps and magnetos. Additional warm air and ventilation is supplied by the cockpit heater, which has its outlet directly in front of the pilot's seat. A high pressure type Pyrene fire extinguisher system is installed to compensate for the elimination of the fire wall.

The Pratt & Whitney Wasp engine of the series, developing 410 hp. at 1,900 r. p. m. and is equipped with a new type of manifold heater, through which hot air from the area surrounding the exhaust is carried to the air intake. The heater is regulated by a manual control. Together with the standard adjustable nose cowling, the heater provides the correct temperature for efficient operation of the power plant.

Instrument installation is complete. Nothing, contributing to safety for flying under adverse conditions,

On the airways of the country

AGAIN reliable reports reveal that at least 85% of the plywood using commercial airplanes operating over U. S. Airlines are built with HASKELITE.

Although reports from some of the smaller companies are not available, definite records show HASKELITE-equipped planes in use by 28 of the 40 commercial companies. These 30 concerns include the largest operators—over 100 planes being operated by Boeing Air Transportation, Inc., National Air Transport Co., and Pitcairn Aviation, Inc.

HASKELITE Users

National Air Transport Co.
St. Tammany Gulf Airlines
Boeing Air Transport, Inc.
Rankin Flying Service
Colonial Western Airways, Inc.
Pacific Air Transport, Inc.
Western Air Express
Aero Corporation of Calif.
Mid-South Airways
Texas Air Transport, Inc.
Thompson Aeronautical Corp.
West Indian Aerial Express
United States Air Transport, Inc.
Royal Airways Company
Compania Mexicana de Aviation
Pitcairn Aviation, Inc.
Continental Air Lines, Inc.
Mutual Aircraft Corp.
Colonial Air Transport
Canadian Colonial Airways, Inc.
Northwest Airways, Inc.
Paul R. Braniff, Inc.
Pan-American Airways, Inc.
Barnes & Gorst
West Coast Air Transport Co.
Western Canada Airways, Ltd.
Union Air Lines, Inc.
Commercial Air Transport, Inc.

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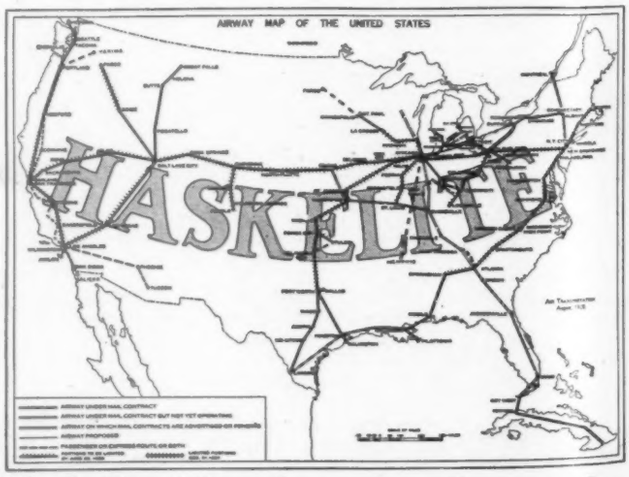

PLYWOOD HASKELITE PLYMETL

A10-27-Gray

Haskelite Manufacturing Corporation
120 South LaSalle Street, Room 1120 Chicago, Illinois

California Panel & Veneer Company
955 S. Alameda Street
Los Angeles, California

Railway & Power Engineering Corp., Ltd.
Montreal, Toronto, Winnipeg, New Glasgow

AS EXPERTS SEE US

J. Warren Smith, McKeesport, Pa., nationally known air mail and transport pilot, passes judgment on the Travel Air Cabin Monoplane.

When J. Warren recently visited the Travel Air factory to take delivery of two Travel Air planes for mail service on the Ball Air Mail lines, he had his first chance to thoroughly inspect, test and fly a standard production Travel Air Cabin Monoplane.

And this is what he said:

1—The same wonderful control in a "Stall" is found in this Monoplane as in all Travel air biplanes. This is especially remarkable in a Monoplane. There is plenty of "Lateral" when you need it.

2—Has the same wonderful load factor and take-off as in all Travel Airs. Load it down, get in the air and you don't know you have a load. Take-off and landing ability in small fields truly remarkable.

3—Consideration given everywhere for lubrication, such as landing gear joints which have bushings and hollow bolts for Alemite oiling: Saves expensive replacement. Gives new landing gear struts for the price of a 25c bushing. All control joints constructed for ease of lubrication.

4—Landing gear bolt corrugated on end to prevent turning; forces friction and wear onto the bolt and bearing; allows the oil to go where it should go.

5—Cross section of wing ribs of wood with grain in separate directions to hold its stiffness; prevents any change in wing curve due to dampness.

6—All nails, tacks and screws plated to prevent rust.

7—Cap strips in wings put on with screws to allow for vibrations and not stick through fabric.

8—Lots of "Dope" around the Travel Air factory; dope enough not only to tighten and finish but to keep linen tight all the time.

9—No hammer or chisel marks anywhere. A finished job in the finest of workmanship.

10—Cabin seats built with consideration of comfort of passenger. They fit the occupant.

11—Pilot's seat so comfortable can fly for 4 to 5 hours without getting tired.

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"In flight, with no effort, the controls are positive and effortless. The stability is remarkable, and, with the fine adjustment of the stabilizer, 'hands off' is no trick at all. The ship always seems to have a firm grip on the air. If stalled, there is no tendency to fall off on a wing, as the nose settles and the ship goes into a glide. It recovers from a spin instantly by simply neutralizing controls. Controls are nicely synchronized. Cruising speed is exceptionally good, and the ship is faster than any other OX-5 job I know of. Top speed, of course, is higher than the other OX jobs. The perfect visibility, smooth action of controls, high cruising speed and inherent stability of the ship puts 'a kick' into cross country flying.

"It is a very easy ship to land. Once on the ground, it does not bounce around, but, due to the design of the landing gear, rolls straight.

"The ship was rolled, looped, spun and put in a dive till the air speed meter 'hit the peg' at 160 miles per hour. This plane outperforms any other ship in its price class I have ever flown."

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with OX-5 Engine
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has been omitted. Flying and engine instruments are in separate groups and those to be used in blind flying are located on a narrow center panel. At the top of this panel is the bank and turn indicator with an additional level indicator below it. Directly underneath this instrument are the earth inductor compass indicator and the altimeter. These have been so arranged that when flying the correct course the three needles are vertical, thus requiring the least amount of effort from the pilot for observation. The earth inductor compass generator

An interior view of the cabin of "The Virginia," showing the installation of the 80 gal. fuel tank, which can be filled while the plane is in flight.

is mounted approximately amidships between the wing and tail surfaces and is a standard Pioneer instrument. The controller or instrument used to set a given course is mounted on the right instrument board and next to it the rate and climb indicator. The ignition switch is located on the left instrument board very close to the throttle and mixture control and can be operated quickly.

As complete radio equipment was installed in the plane, it was necessary to radio-shield the engine. A special radio generator of Hartz design, having dual armatures and single field, has been mounted in place of the regular generator on the engine. Due to the size of this generator it was necessary to divide the exhaust manifold in two parts thus providing two exhaust outlets, one on each side. The left hand exhaust pipe is connected to the cabin heating unit, which is mounted under the floor.

The specifications furnished by the manufacturer are as follows:

Overall length	36 ft., 7 in.
Overall height	8 ft., 11 in.
Wing span	30 ft., 7 in.
Wing area	370 sq. ft.
Fuel capacity	385 gal.
Number of tanks	4
Performance:	
High speed	140 m. p. h.
Cruising speed	118 m.p.h.

(*Continued on page* 1354)

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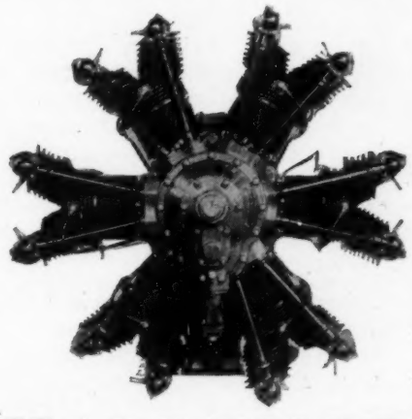

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KINNEAR ROLLING · DOORS

(*Continued from page* 1352)

Landing speed ..... 42 m. p. h.
Climb ..... 1,000 ft. per min.
Climb to 10,000 ft ..... 15 min.
Service ceiling ..... 18,000 ft.

The "Cavalier" Monoplane

(*Continued from page* 1324)

when it is desired to use the plane for instruction. All unnecessary parts have been eliminated from the control system. Ailerons are hinged at the top and are actuated by a push-pull rod attached at the bottom. The rod is operated from a bell crank just behind the rear wing spar. Elevators are mounted on a single torque tube having a crank inside the vertical fin. Conventional horns and cables are used in the rudder control.

Landing gear is of the split axle type with a 5 ft. 6 in. tread. The tail skid consists of a steel leaf spring secured just below the tail post.

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A front view of the new "Cavalier" two-passenger, cabin monoplane, manufactured by the Star Aircraft Co.

Petroleum Co. The Star Company is, however, a private enterprise with ample funds for unlimited expansion.

Specifications of the Cavalier as submitted by the manufacturer are as follows:

Wing span ..... 31 ft. 6 in.
Overall length ..... 19 ft. 8 in.
Overall height ..... 6 ft. 3 in.
Chord ..... 5 ft. 1 in.
Wing area (including ailerons) ..... 157 sq. ft.
Aileron area ..... 17.85 sq. ft.
Rudder area ..... 6.5 sq. ft.
Fin area ..... 3.7 sq. ft.
Stabilizer area ..... 12.8 sq. ft.
Elevator area ..... 8.8 sq. ft.
Weight without engine ..... 476 lb.
Weight without engine and equipment ..... 740 lb.
Useful load ..... 575 lb.
Wing loading ..... 8.31 lb.
Power plant .... Velie M-5, 5 cylinder air cooled, 45 hp.
Fuel capacity ..... 26 gal.
Oil capacity ..... 3 gal.
Propeller ..... Hartzel or Hamilton
Control ..... Stick
Performance:
Maximum speed ..... 105 m.p.h.
Cruising speed ..... 87 m.p.h.
Landing speed ..... 38 m.p.h.
Climb (full load) ..... 800 ft. per min.
Climb in 10 min ..... 6,500 ft.

(*Continued on page* 1356)

The Aviation Industry

We have prepared an extensive study of The Aviation Industry, reviewing its past and presenting in much detail its present status, both commercial and financial, and future prospects. Copies are available upon request.

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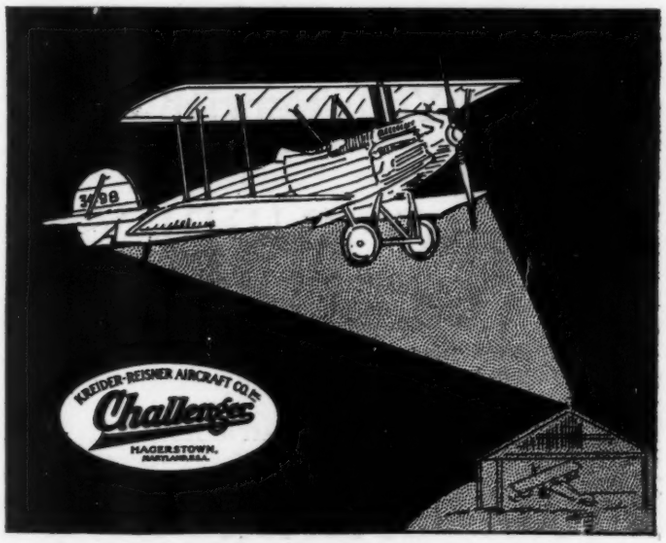

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COLLEGE POINT L. I., N. Y.

(*Continued from page* 1354)

Service ceiling	12,000 ft.
Fuel consumption	6 gal. per hr.
Oil consumption	1.25 pt. per hr.
Take off in dead calm within	200 ft.
Land in dead calm within	150 ft.

True Altitude Meters

(*Continued from page* 1323)

mitter setting the length of the wave is always the same as are the distances between O, WW, XX, YY and ZZ.

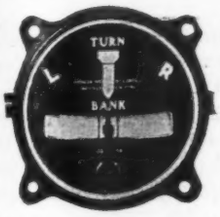
The early attempts endeavored to make use of that portion of the wave between O and WW, and chose a wavelength of about 8,000 ft. A small transmitter radiated the wave which, after reflection from the earth, was picked up by a receiver connected to an indicating device. If the airplane were at an altitude of 2,000 ft. a maximum deflection was expected to be obtained on the meter, at 1,000 ft. a predetermined lesser deflection, and so on. It was found at the time that none of the anticipated variations were obtained because, we now know, that it is virtually impossible to obtain reflections of long radio waves.

The experiments along these lines were permitted to lapse until comparatively recent times when the advent of short waves, which are readily reflected, gave new impetus to the development of a standing wave altimeter. A short wave transmitter, collector and indicator is now being investigated. While good reflections are obtainable a new problem has been encountered. As shown in (a) of Fig. (2) the distance O-ZZ now approximates 100 ft. while the quarter wave is only 25 ft. Hence the present practice is to rely on observing the points of maximum and minimum readings, disregarding the intermediate variations. Recent flights have shown that marked peaks and valleys can be obtained corresponding to the nodes and antinodes in the standing wave.

There is no longer any question but that this method will delineate clearly when the aircraft passes through a node or antinode of a standing wave. There is doubt, however, as to the means by which it will be possible to identify which particular node or antinode is being passed. Obviously it helps but little for the pilot to know that he is 25 ft. lower or higher unless he is accurately informed as to his previous altitude. A possible solution lies in the fact that, as the altitude increases, there is a corresponding decrease in the amount of deflection between maxima and minima. It is now contemplated that the indicator shall be calibrated in terms of variation intensity which should considerably assist in the determination of actual altitude, especially when flying over an area having uniform reflecting properties. The value of an intensity calibration when over land with all the variegated reflectors represented by buildings, trees, etc., is doubtful.

The solution of the altimeter problem by some modification of the standing wave method is being thoroughly investigated by competent research workers. They are handicapped by the limited knowledge which now exists concerning the properties of radio waves. Should their present efforts prove fruitless it is not improbable that the future may bring forth new promise for the application of standing waves in the determination of altitude.

A second type of electric altimeter is called the Capacity Altimeter and is based on the principle that the capacity of an electrical conducting system changes with any change in the relative position of the parts in the system. The specific idea of using the change in capacity as a measure of the altitude of an aircraft appears to have originated in England ten or twelve years ago, though



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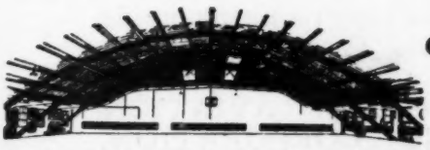

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many people in this country independently suggested the same idea.

Referring to Fig. 3 (a), X and Y are two plates mounted on the aircraft and connected to measuring device Z. The dotted lines represent the capacities which exist between the plates and ground. Fig. 3, (b) shows the equivalent circuit and indicates more clearly how the distance of X and Y from the third plate or ground may have an appreciable effect on the capacity between X and Y. Perhaps none of the true altimeter methods looked so simple and practicable on paper as did this one. Various schemes were evolved to measure the changes in capacity, among them being the heterodyne beat, resonance and simple bridge methods. The results were markedly variable. Some investigators reported success at great altitudes, others conservatively estimated the maximum altitude measurement possible to be not over 10 ft., while a third group found that the instruments gave usuable indications only when the tail skid was touching the ground. The extraordinary diversity in the results led to more careful research into the fundamentals of the scheme. The reason for the apparent success of several capacity altimeters was soon discovered. They were functioning at high altitudes but were not measuring the capacity change between X and Y due to the position of the ground but were measuring the change in capacity due to variation of the dielectric constant of the air. To explain—the capacity of a condenser is a function of the material between the condenser plates, and if the material

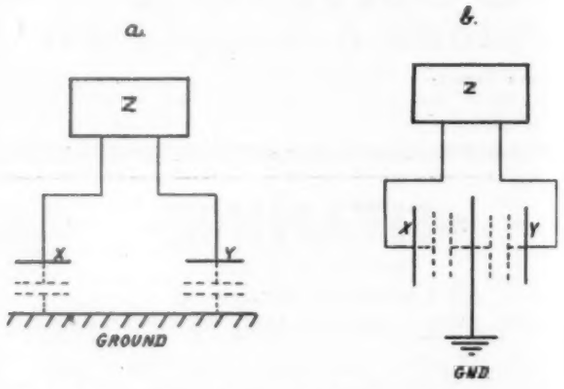

Fig. 3. A diagram of two equivalent circuits, showing the capacity effect between the metal plates and ground.

varies, the capacity varies. As air becomes more rarefied at the higher altitudes it follows that the capacity of the condenser formed by the two plates as shown in Fig. 4 will change in proportion. Since the density of the air is a function of the barometric pressure, the supposedly successful altimeters were merely electric barometers, with the limitations of electric measurement added to barometric variations. Having demolished the hopes of the apparently successful workers, investigators next turned to the failures. Here, too, the answer was relatively simple. Models had been built, usually, before a careful analysis had been made; and on the assumption that the capacity changes involved were relatively large. Actually the capacity variation to be measured was extremely small—measurable, but only by the finest of the laboratory instruments then available.

It was at once obvious that the success of the capacity altimeter depended on the development of an entirely new technique which would permit precise measurements under service conditions.

There is, at the present time, at least one successful type of capacity altimeter which shall henceforth be designated in this article as the Gunn altimeter, so named for its inventor, Dr. Ross Gunn. Dr. Gunn began the

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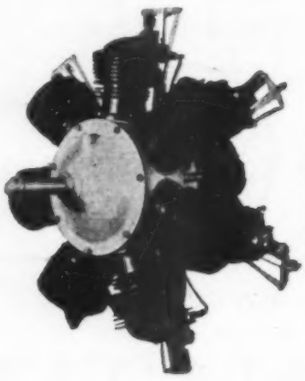

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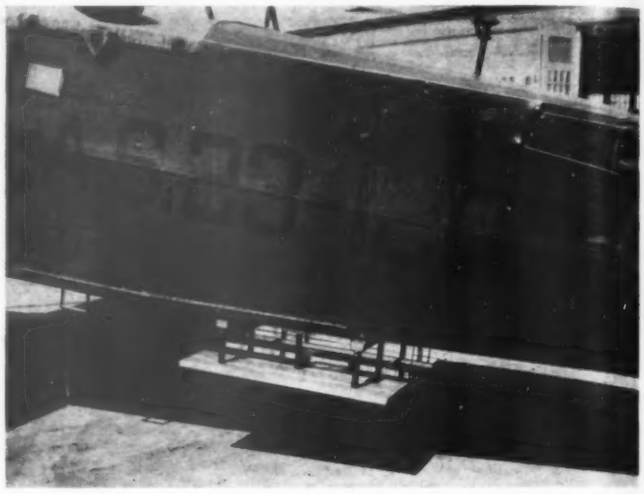
development of this altimeter in 1924 while a member of the faculty at Yale University. Late in 1925 a flight model was completed and tested by the inventor at McCook Field. The results while only partially successful were sufficiently encouraging to warrant further development. Two additional models ordered by the Army are now undergoing further study.

The essential features of the Gunn Altimeter are four in number: (1) The capacity elements. These may be plates, wires or part of the existing structure as the case may be. It is, of course, necessary that these elements be properly chosen or suitably mounted. For instance, it was quickly discovered that plates mounted in the wings were not desirable because of errors due to wing flexure. (2) The oscillator unit. This is contained in a small box which may be located at any place in the fuselage. This unit comprises an exceptionally stable circuit developed especially for the purpose, a differential balancing network also of special design, the vacuum tubes and controls. The oscillator unit is adjusted upon installation in the airplane but needs no attention thereafter. (3) The control unit, another small box which should be placed in a position convenient to the pilot. It contains switches to turn the instrument on and off, a dial for the "infinity" adjustment to be explained later, and may contain the indicator though this meter can be located on the instrument board. The indicating meter is calibrated directly in feet and may be read like any similar appliance. (4) A dry cell battery of 100 volts. This need weigh but five pounds and can also be placed anywhere in the plane. The total weight of the latest apparatus complete—oscillator, control unit, capacity elements and battery is less than 20 lb. and a substantial reduction of weight is anticipated in the forthcoming model.



A photograph showing the mounting of the capacity plates below the fuselage in the first trials of the Gunn altimeter. The practice, which is being employed at the present time, is to use selected parts of the fuselage or landing gear as the capacity elements.

The operation of the instrument is very simple. A switch is snapped "on" and the dial turned until the meter needle reads at the top of the scale (100 ft.). This last operation is called the "infinity" adjustment, corresponds to the usual "zero" adjustment and may be made at any altitude over 100 ft. It is recommended that the instrument be turned on a few minutes before use is contemplated in order that the tubes shall have a chance to settle down. Five minutes usually suffices. Then the infinity adjustment can be made and the altimeter is ready for use. There are no trick adjustments whatsoever, the entire process engaging but a few seconds of the pilot's

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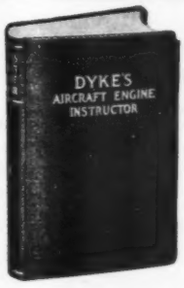

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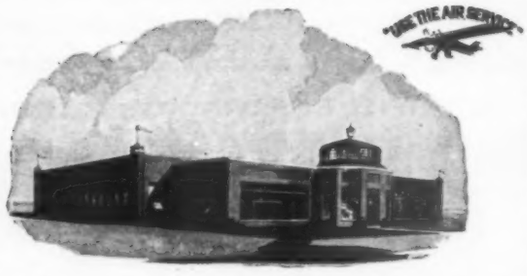

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time and requiring no special knowledge or precaution other than the warming up period prior to use.

The tests already made have shown that the Gunn altimeter possesses very desirable characteristics. First of all it gives the true altitude above the ground over which the plane is flying, irrespective of pressure, weather and fog conditions. Secondly, it gives a continuous and accurate reading without attention, enabling the pilot to concentrate on his flying with an occasional glance at the instrument. Third, the sensitivity increases as the plane nears the ground. For instance, at 100 ft. a change of five feet is noticeable, but at 20 ft. a change of five inches will produce a similar change on the indicator. For landing in foggy weather this feature is of highest importance since the pilot can judge accurately the proper time for levelling off. Fourth, the "infinity" adjustment is made in the air, at any altitude above the highest point on the meter, and at any time prior to the actual use of the altimeter.

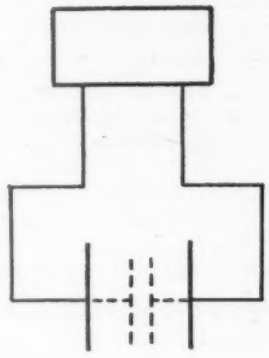

Fig. 4. A diagram showing the capacity between two metal plates. The capacity between two metal plates changes with any change in the material between the plates.

It has been stated before that the capacities dealt with are very small. For this reason the present models of the Gunn altimeter are limited in their performance to altitudes of 100 ft. and less. Hence the instrument finds its use only for landing purposes or for special flights at low altitudes. It is anticipated that the usable altitude range may be increased fifty or even a hundred per cent. in future models now in process of development.

Despite the remarkable stability of the circuits there is still a slight tendency to drift. It is therefore necessary to correct the infinity adjustment at long intervals during flight. A slight movement of the dial resets the needle to infinity and the instrument will remain properly adjusted for an hour or more. Dr. Gunn anticipates that his newer models will practically eliminate the necessity for any adjustments after the initial one made at the beginning of a flight. The principal requirements for successful operation of the Gunn electric landing altimeter seem to be proper installation and ordinary intelligent management.

The several types of altimeters discussed in this article have been developed largely as a matter of private initiative and to fulfill a need which was still indefinite. Rapid expansion of our airlines with necessity for regular schedules has focussed the attention of the leaders of the industry on the necessity for better instruments. The possible coordination of investigation and effort by the newly created Guggenheim Commission should prove of great value, both in the research into new methods and devices for the determination of altitude, as well as in the rapid development of existing equipment to the point of commercial application.

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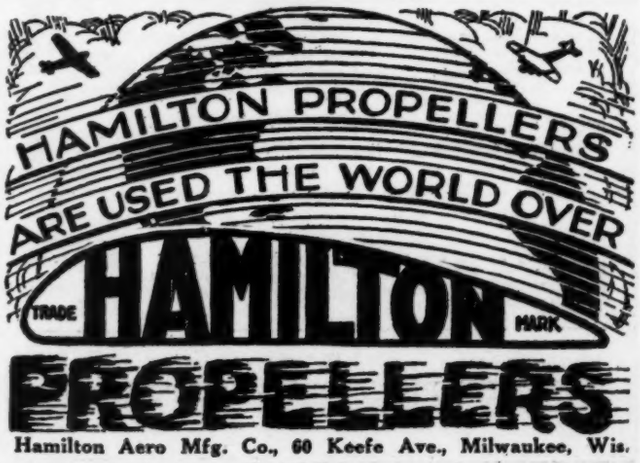

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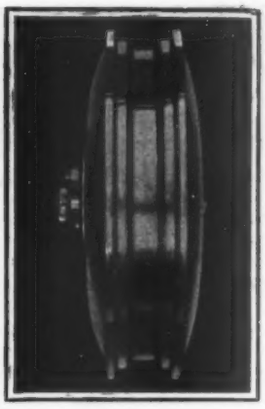

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SIDE SLIPS

By ROBERT R. OSBORN

As there are probably quite a few readers of Aviation who are not also readers of the Hearst newspapers, we had better make the announcement that a large dirigible, named the "Graf Zeppelin," arrived at Lakehurst recently after a 111 hr. flight from Germany.

* * *

The German crew of the Zeppelin are making a considerable fuss over the fact that a horizontal control was damaged during the flight and was repaired in the air by four members of the crew. We refuse to be impressed or "het up" over this news, however. Haven't our own California fliers been repairing landing gears, overhauling motors and changing propellers in flight for years now?

* * *

Envelopes bearing four mark stamps which were carried over on the dirigible have now risen in value and are selling for three dollars each. The Intrepid Aviator says he supposes this is because it took the ship so long to get here that the stamps now have an antique value.

* * *

We take the liberty of reprinting the following excellent comment from the "Left at the Post" column in the New York "Evening Post," the editor of which, Mr. Russell Crouse, is so enthusiastic over the Zeppelin flight that his friends assure him he has become "lighter-than-air minded." He says, "No smoking was permitted on the Graf Zeppelin, possibly because blindfold tests interfere with steering."

* * *

The newspapers say that there was no liquor on board the ship when it was inspected by our customs men, whatever liquor was on board having been consumed before the trip was half over. We're not pointing out any connection between the two items, y'understand, but just about in the middle of the trip was when the ship left off its erratic course and started coming straight for Lakehurst.

* * *

We'd like to inquire if the reporter for the New York "Sun" was directly quoting the naval officers when he wrote his copy: "Following a superficial examination of the damaged fin of the ship naval officers said that it would take from six to eight days to repair it. The fabric must undergo an intricate process of preparation before it can be *fitten* to the framework."

* * *

It would be interesting to learn the final outcome of the business venture of a bus driver in Times Square, New York. K. H. saw his bus there two days before the ship arrived, with the sign on the side, "Round trip to Lakehurst and return, $3. See the Zeppelin arrive." K. H. found on inquiry that the driver was going to Lakehurst as soon as he got a load and would stay there until the dirigible had landed.

* * *

A good conception of how much the uncertainty of news from the dirigible and the delay in her trip upset the plans of the reception committee, can be gained from the report that four hardy gardenias wilted into eternity on the coat lapel of Mr. Grover Whalen, the ever-present and ever-immaculate official greeter of New York City.

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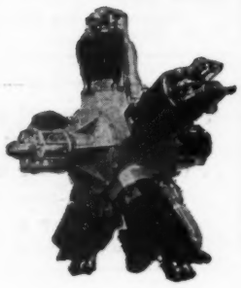

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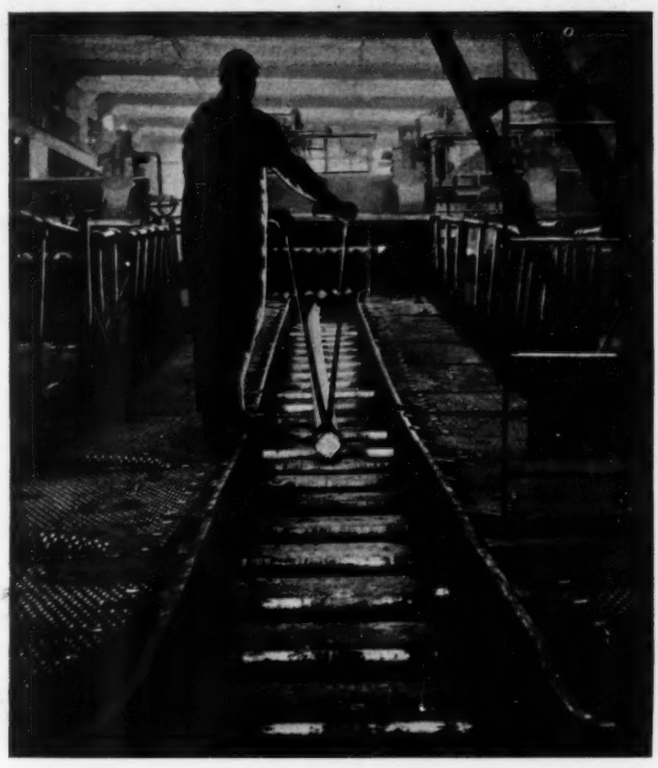

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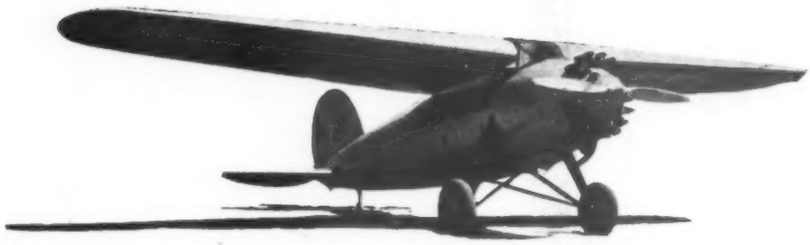

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